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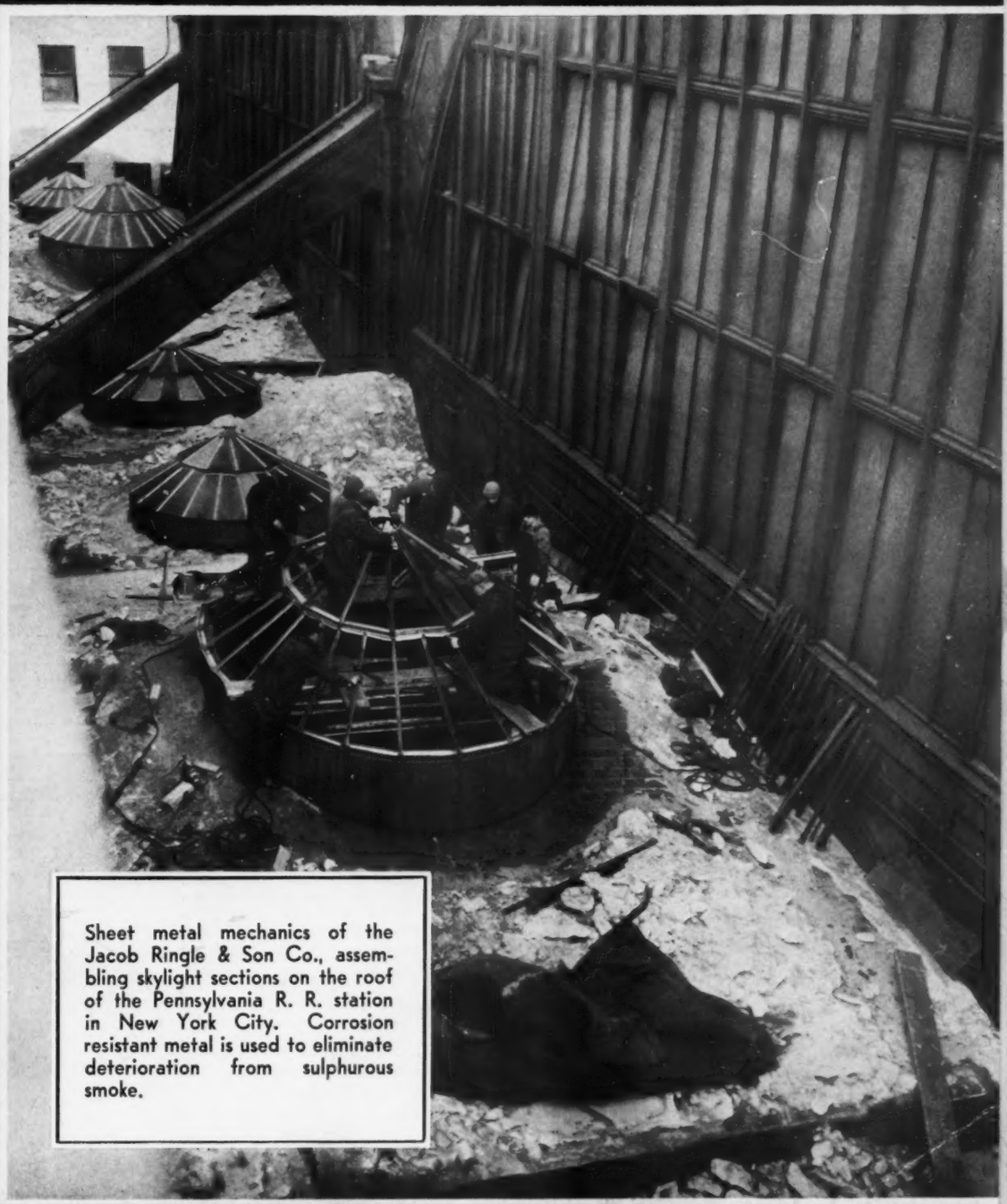
SHEET METAL CONTRACTING

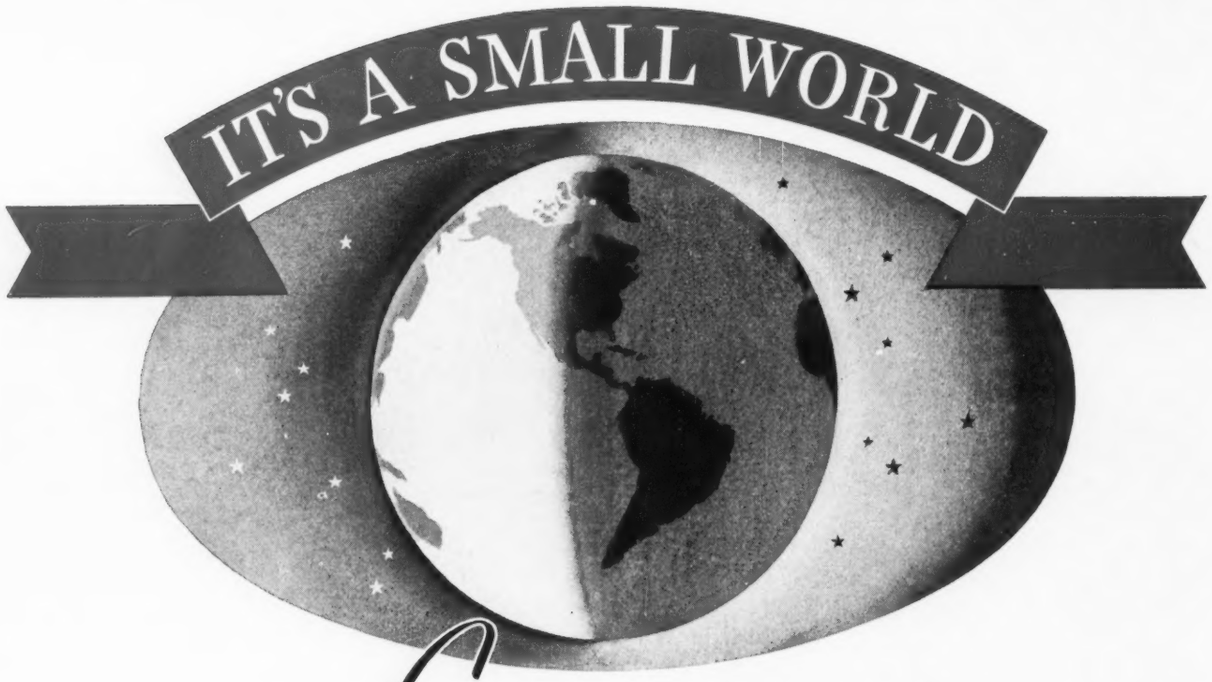


Sheet metal mechanics of the Jacob Ringle & Son Co., assembling skylight sections on the roof of the Pennsylvania R. R. station in New York City. Corrosion resistant metal is used to eliminate deterioration from sulphurous smoke.

ESTABLISHED
8 8 0

APRIL
1936

THE AIR CONDITIONING SECTION



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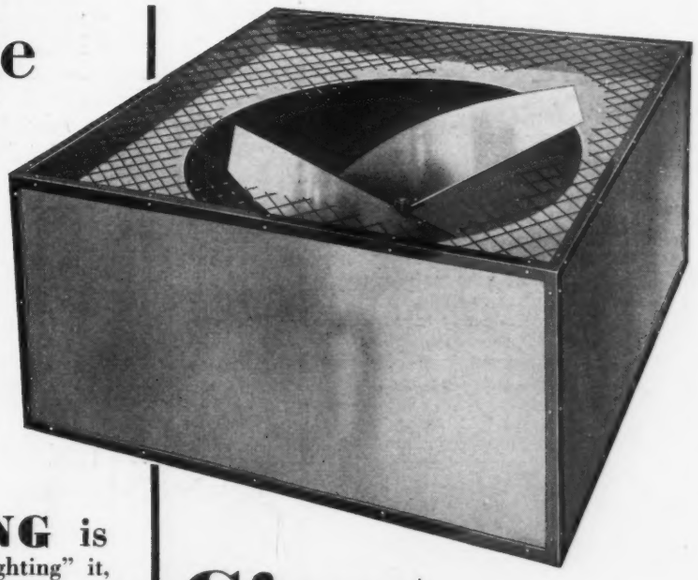

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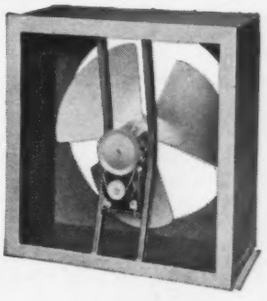

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In This Issue

Although metal is a long-lived material, sometimes atmosphere attacks it. An example of replacement using metal especially designed to resist disintegration is related on page 12.

*

Perhaps not many readers will be concerned with removal of lint and dust in oil mill shakers, but the principles can be applied to other materials. Read J. W. Baybutt's article on page 14.

*

We all must now make plans for keeping track of wages upon which social security taxes will be levied. A resume of the provisions of the act is published on page 17. Your questions are invited.

*

On page 18 appears the first of a series which will cover the patterns and construction of all types of skylights. Wm. Neubecker, the author, is well known. Estimating quantities will be taken up in each article.

*

If you liked our first article by Carl Wilson on welding in the March issue you will find his article in this issue (page 20) even more practicable.

*

A report of Ohio's 36th annual convention is on page 67. The meeting emphasized new trends of thought (licensing ordinances, for example) and proved to all attending that business is improving at a tremendous rate.

*

We are continuing the Minneapolis code. The sections in this issue take up oil burning apparatus and installations.

*

S. Konzo writes an article which we consider one of the best in his long series of "best" articles. This one is on resistance in ducts and elbows. He sets new "yardsticks" for estimating the amount of resistance and providing for it in the design.

*

One of the interesting papers at last June's ASHVE meeting dealt with fuel savings resulting from shutting the smoke pipe whenever the burner is "off." The first half of that report appears on page 29.

*

Heating with oil at coal cost and cooling to 70 degrees in summer was the specifications for a Detroit installation described on page 36. The details of design are applicable.

*

G. A. Voorhees continues his outstanding series on converting gravity to forced air on page 38. He considers the ticklish problem of return air.

AMERICAN ARTISAN

With which is merged

FURNACES AND SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

Vol. 105 No. 4 **April, 1936** **Founded 1880**

CONTENTS

A Job to Do and Give This Some Thought 11
Combat Disintegration with Weather Resistant Metal .. 12
Separators Remove Lint and Dust in Oil Shakers 14
A Table of Models Which Built Sales 16
Social Security—A Resume of Its Requirements 17
Skylight Construction 18
Welding Procedure for the Sheet Metal Shop 20
A Contractor Modernizes His Own Basement 22
Ohio's 36th Annual Convention 67
Minneapolis Heating, Air Conditioning Ordinance 69
New Literature 72
With the Manufacturers 75
Letters from Readers 78
Association Activities 82
The Problem Corner 85
New Products 89

THE AIR CONDITIONING SECTION

Oil Burning in Residences 29
Frictional Resistance of Ducts and Elbows 32
Controls for Domestic Conversion Gas Burners 35
An Oil Fired Installation in the Latest Mode 36
Converting Old Gravity Systems to Forced Air 38
Heat Loss Calculations for Space Heating 40
Frost and Condensation on Windows 44

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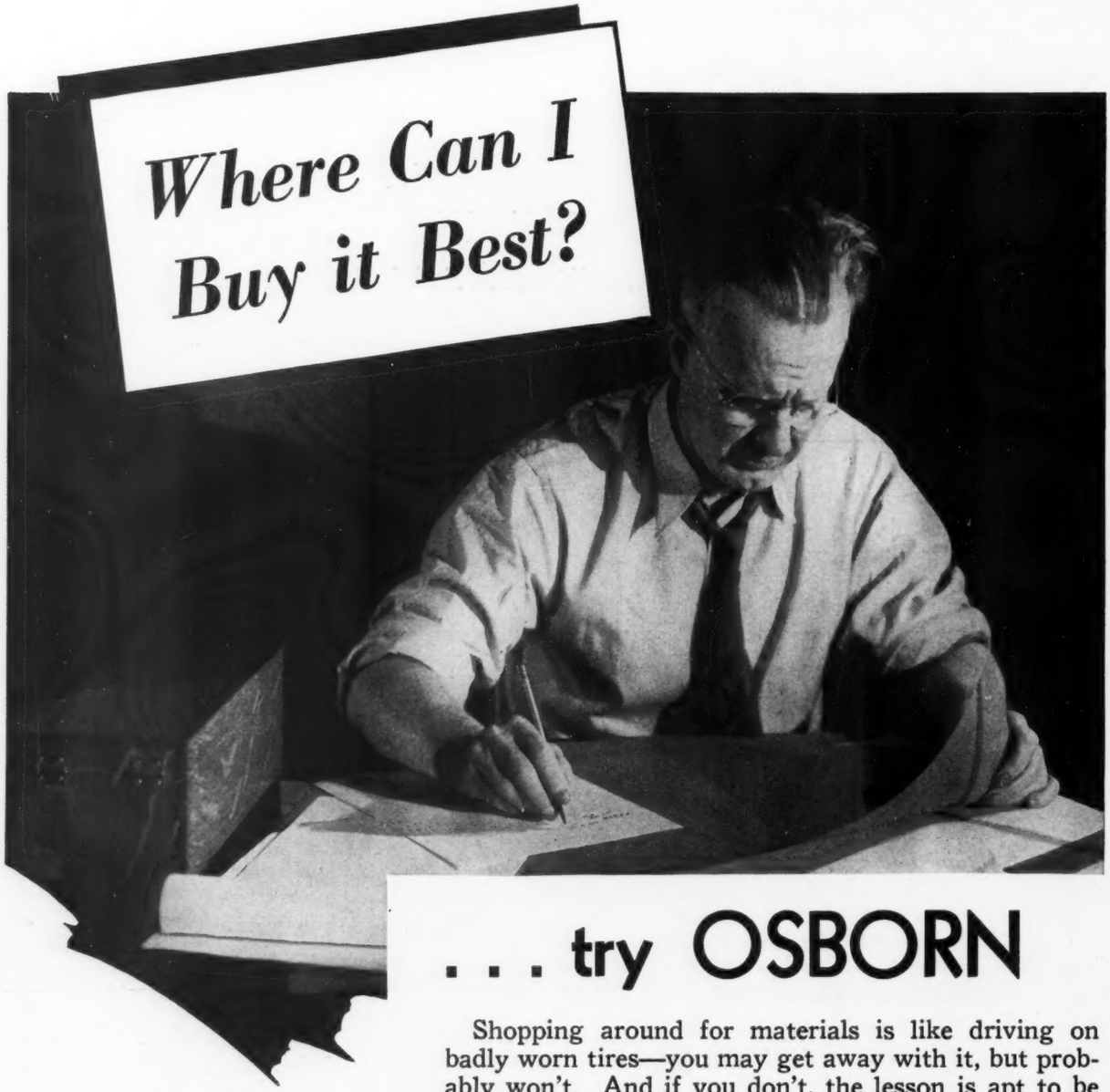

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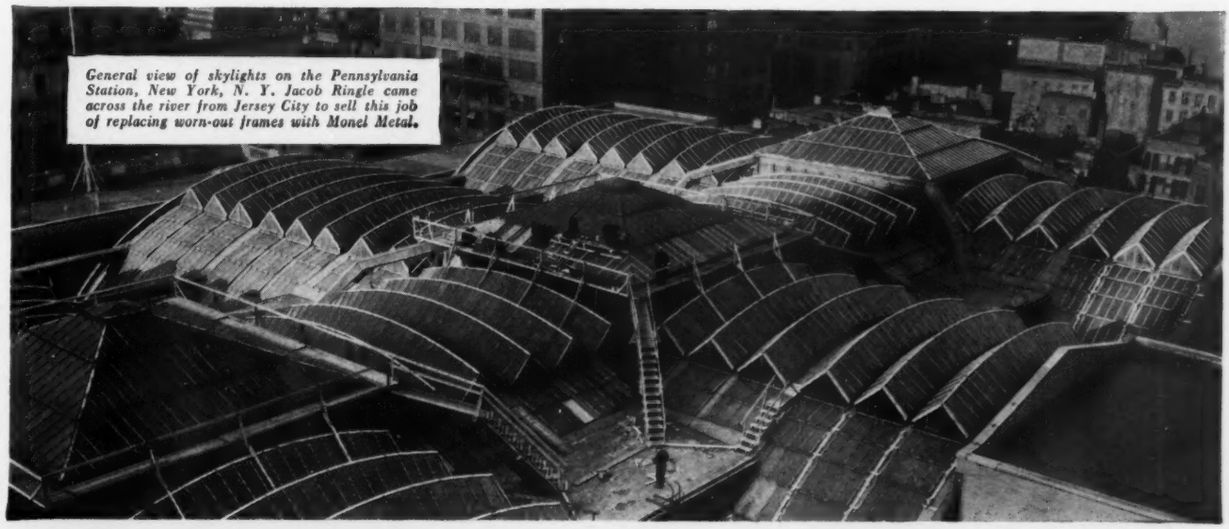

General view of skylights on the Pennsylvania Station, New York, N. Y. Jacob Ringle came across the river from Jersey City to sell this job of replacing worn-out frames with Monel Metal.

And how can the MONEL METAL *on the roof of the Penn Station help you get the jobs?*

LOOK around you at the roofs in your neighborhood. Aren't there some dollars for you to make by selling roofing jobs of Monel Metal?

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But *you* know it costs a lot *less* in the long run. And all property owners aren't penny pinchers. Some of the owners of banks, garages, theatres and schools would rather pay a trifle more now, and know they are *through* with patching and repairing. Go tell them the story of the Penn Station in New York.

And what a story of long wear it is. The workmen you see in these photos are not repairing the *roof* of the Penn Station. The roof itself is Monel Metal, put down back in 1910 when the station was built. What they are replacing is the only part which was *not* Monel Metal—the skylight frames. And of course they are using Monel Metal to replace them.

These skylight frames have faced the same attacks of damp, coal-grime, and fume-laden air as the Monel Metal roof. They quit, worn through by corrosion. While the Monel Metal roof, engineers say, looks good to last until the year 2200!

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OFF WITH THE OLD . . .
(Right) Workmen removing the old corrosion-eaten frames on the Pennsylvania Station.

ON WITH THE NEW!
(Left) Bolting down the new Monel Metal frames, to end at least for a generation the need for further repairs.

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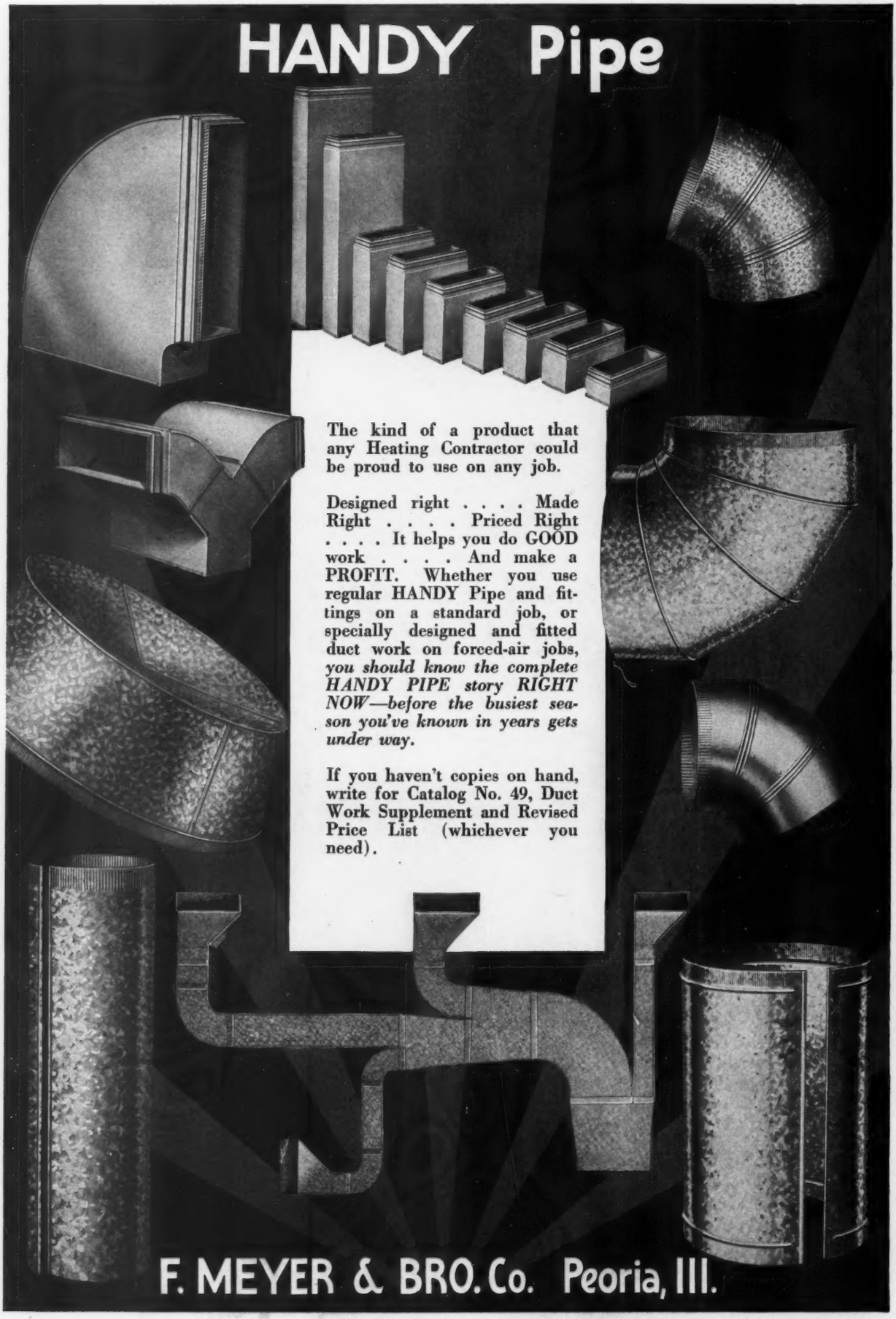

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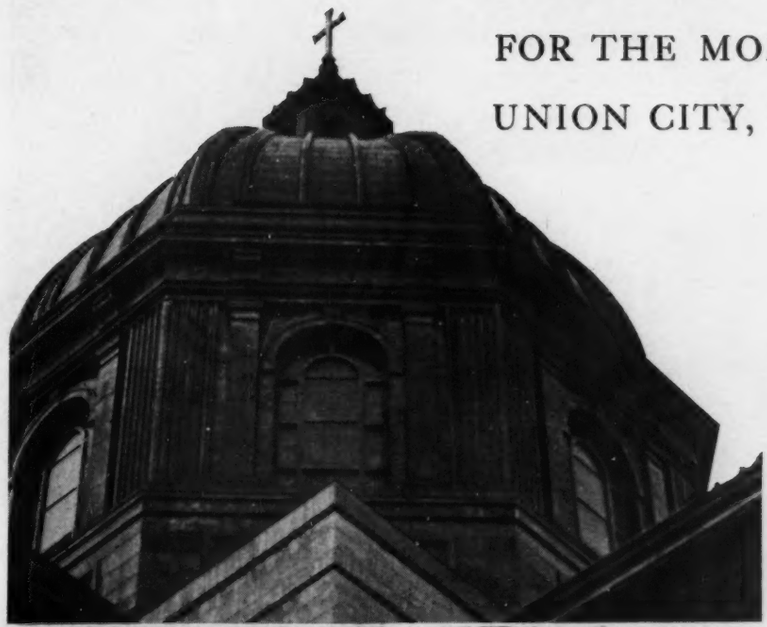

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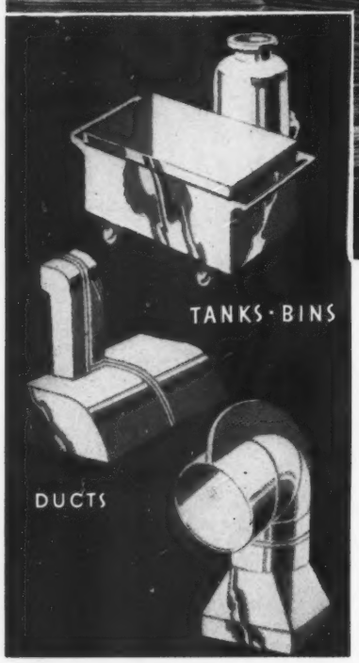

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STEEL - SERVICE

AMERICAN ARTISAN
Volume 105 Number 4

Give This Some Thought

When the Air Conditioning section of AMERICAN ARTISAN was started in 1931 we called attention to a condition which we asserted would cause trouble. The warning was focalized in an editorial appearing in the November, 1931 issue under the title "Standards of Air Conditioning."

Today we are feeling the results of our easy going attitude. In the years since 1931 literally dozens of improperly tested, rated, and unsound products have been introduced and sold as air conditioning equipment. The home owner has not been able to separate the sound from the unsound, the mechanically correct from the incorrect, the wild claims from the conservative guarantees.

But how can the home owner use good judgment, when he hasn't a measuring stick? How can the owner judge whether an apparatus will do what is claimed? How can the owner judge whether he is going to get humidification, cooling, dehumidification, cleaning, automatic heat supply, uniform temperatures when each contractor touts the virtues of a particular piece of equipment and blandly asserts that every other unit will not deliver its claimed characteristics?

While we can't make expert judges of the owners, we can give any owner a set of specifications which if lived up to will mean a satisfactory installation for the owner. Also, such specifications will eliminate most of the foolish, wild, unsound claims and apparatus now flooding the market.

All the owner will have to do is to buy a system which will deliver according to the specifications. In order to assure himself of actual delivery he has only to eliminate those firms which are financially unsound and buy from a firm able to make good its claims.

Further, the owner will not have to waste time listening to the wordy claims of the gadget makers. Will it give me these features? That will be the question.

We believe that the time has come when this industry should, through its local and state associations, its national organizations, its manufacturers' facilities and its research laboratories, set up these standards for domestic air conditioning. The longer we delay the harder will be the task of setting up reasonable specifications and the more disillusioned will be the buyer.

◆

A Job to Do

In fifty years of trade association activity no one has been able to knock down the assertion that an association exists only so long as it has two things. First, several willing workers, ready to devote time and energy to promoting the organization. Second, something of a dollar and cents nature to work for.

Unfortunately, too many associations have killed off the enthusiasm of the willing workers by forgetting to give them something of a dollar and cents value to work with.

Two years ago we had our industry codes. Despite bad times contractors flocked to meetings because they wanted to know how the code was going to affect their pocketbooks. The codes died out and so did the interest.

This year, probably because times are better, increased interest in associations has been manifested. But associations can't hope to hold and increase this interest unless the association offers something of a dollar and cents value.

Is there such a proposition?

We believe there is.

Installation ordinances and licensing laws.

When we suggested installation ordinances and licensing laws several years ago, we were ridiculed. Nevertheless, we have not lost belief in the efficacy of such legislation to solve most of the problems of the industry. Just because similar laws have not worked satisfactorily in one community is no reason to condemn the whole idea. Just because another trade has not found licensing satisfactory does not prove our rules can't be useful.

As we see it, this whole proposition is rapidly coming to a head. There's far too much sloppy design and installation. Too many buyers have been sold a mess of conversation. The industry we look upon as our birthright is being stolen from us by other crafts and groups who have been smart enough to establish their recommendations while we still talk about ours. Frankly, there's too many contractors installing gravity, forced air and air conditioning systems who should be mechanics working for some contractor; too many mechanics taking sheet metal work for day wages.

These conditions surely do not help us to make money or to give the public what it thinks it is buying.

"Talking up" ordinances requires organized propaganda. One man can't do the job by himself. But a group of men, no matter how few, if willing, ought to be able to attract others of the same feeling into any movement which means profit for the industry.

Here's a job for the associations to do.

By R. C. Nason

Looking out over the station roof composed chiefly of some 83,000 square feet of skylights. Note the several types of skylight and the large amount of metal required to support the glass.

Combat Material Disintegration On Skylights With Weather Resistant Metal

Modernization of 60,000 Sq. Ft. of Station's Skylights, Chiefly by Way of Frame Protection, Requires 15 Tons of Metal Strip and 50,000 Bolts

BIG-CITY grime, dust and sulphurous smoke continue to take heavy toll in the disintegration of skylights, thus bringing substantial modernization contracts to sheet metal contractors. One of the outstanding cases recently observed is in connection with New York City's famous Pennsylvania R. R. Co. passenger terminal, whose skylights now are being renovated by Jacob Ringle & Son, Jersey City, N. J., sheet metal contractors.

Readers who recall the opening of this giant structure some 27 years ago possibly remember that its roof possesses unusually expansive skylights (83,000 sq. ft.). In specifying non-corrosive material for bar covering, the architects felt that the problem of protection against city smoke and dirt had been solved for all time. Such, however, proved not to be the case, for pitting and erosion began to be serious last year, metal failure occurring in 60,000 sq. ft. of the total skylight area.

To the Ringle firm was delegated the work of correction. The successful experience of the railroad people with nickel-copper metal, laid in flat sheets over 300,000 sq. ft. of the terminal's roof 27 years ago, suggested its use for the modernization now nearing completion.

Unless one is acquainted with the general construction and design of the skylights here concerned he finds it difficult to appreciate the complexity of the sheet metal contractor's task. Almost every style of skylight is represented. About one-fourth of the area consists of saw-tooth lights, another fourth is monitor,

Viewed from the inside, the roof appears to be practically all glass. Study of the two photographs on this page show how much metal was required.

while another fourth is flat. The remainder is curved, or domelike, in contour.

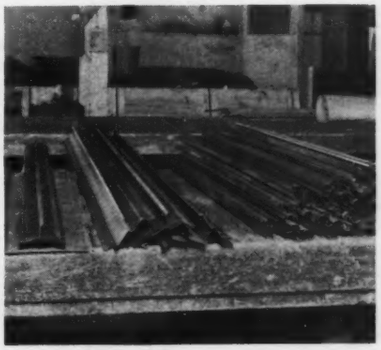
Metal failure did not occur over the entire area. Some sections remain in good condition, others required immediate attention. These features prevented precise specifications covering the repairs; instead the contractor was given some little discretion as to renewal to insure positive tightness and protection at all points.

Most of the ribs, or frame work, of the big skylight proved sound and suitable for continued service. But when unsoundness was encountered, as was true over 1,000 linear feet, replacements were made. Practically all of the sheet metal rehabilitation now in progress concerns replacement of flashings, battens, caps, bar coverings and the like. Old glass over most of the area was removed and new wired glass ⅜-inch thick substituted.

The contractor's metal work called for 15 tons of nickel-copper strip, considerable 20-oz. copper sheets and 50,000 nickel-copper bolts. Skylight frame covering pieces, or strips, each 6 ft. long and from 12 to 20 in. wide, varying according to requirements, were fabricated in the Ringle shop on power shears and brakes, bolt holes were punched on a power punch, then the finished pieces were shipped to location ready to apply.

About 20 mechanics have been busy for the past 60 days removing old glass and sheet metal with cold chisel and mallet, then wire brushing the frames (mostly of steel) ready to lay the new covering pieces and monitor caps. As already indicated the new copper and nickel-copper work is all bolted down.

Mechanics are shown bolting on the caps (which are new) over the bars which were practically all in good condition. The new caps are made of Monel metal for weather resistance.



Caps, sills, base sections as formed in the Ringle shop in short sections and punched for the bar bolts.

Mechanics are removing old exterior metal and caps, straightening underneath metal and applying new glass and new Monel metal. Note deterioration of some of the flashing.

No putty was used. Tightness was attained between metal work and glass upper surfaces with lead ribbon, glass underside contacts were treated with white lead. This method long has been a favorite one with Jacob Ringle, head of the sheet metal contracting company. Altogether about a ton of "T" lead ribbon was required.

Without going into elaborate details it can be said that the contractor's order included, "new caps, bolts, flashings, battens, glass, resoldering, gutter cleaning, bar replacement, cap replacement, metal sash," every duty, in fact, to insure tightness over the entire 60,000 sq. ft. area.

For instance there were specified, 450 linear ft. of seam repairs, 300 ft. of ridge tops, 500 ft. of batten ends, 30,000 ft. of caps, 12,000 ft. of eaves closures, 1,000 ft. of gable ends, 1,000 ft. of bars, 1,000 ft. of cap flashings, 500 ft. of base flashings and 10,000 sq. ft. of terra cotta roofing in addition to the 60,000 sq. ft. of skylights.

The skylight frames originally supplied are continued in service except about 1,000 linear feet despite the failure of their caps and other sheet metal coverings. It is anticipated that the new sheet metal work will endure for the next century at least.

Four Separators For Removing Lint and Dust From An Oil Mill Shaker

A reader submitted this problem in material separation and collection. While the material is unusual, the method is similar to the schemes used for other materials. The composite drawing on the facing page shows details of four types of collectors and separators employing cloth, paper, water and expanded space.

By J. W. Baybutt

Instructor, Rochester Athenaeum and Mechanics Institute

IN answer to a reader's request for information on dust removal from an oil mill shaker, let us assume that the existing arrangement is about as shown in Fig. I and II. The idea in the dust house installation is to reduce the velocity of the air flow to such a point that the undesired material will drop out of the air stream due to its own weight.

In the case of lint, this velocity has to be so low that an impractical installation would be needed to handle the air. With velocities lower than 25 f.p.m. measured by a Kata thermometer, lint particles can be seen floating about in the air stream if a strong light is used in the viewing. The size of the dust house would assume tremendous proportions to allow even this velocity much less any lower velocity than 25 f.p.m.

Cloth Filters

In connection with the existing dust house on this problem we would suggest adding paper or cloth filters as per Fig. III and IV. To keep down power costs, the air velocity through the filter material should be kept down to 5 f.p.m. Assuming that the fan is handling 5,000 c.f.m., then 1,000 square feet of cloth would be needed. If the expense of such an installation cannot be justified, a higher velocity could be used, but higher operating and maintenance costs will result. A fan speed of 3,100 r.p.m. appears too high for a 40-inch fan unless it is built specially for such service.

To determine the air handling capacity of a fan, with any degree of accuracy, the width and height of the casing, the type of wheel, number of blades, static pressure (both before and after fan) should be given in addition to the speed.

Paper Filters

If standard paper filters are preferable to cloth it is a good policy to request information from the manufacturer on the velocity through the paper and the static pressure required at the start at the rating recommended for this service. Ordinary ventilation rating would not be recommended on this work as the operating cost both for power and replacement would be high.

It is impossible to estimate the pressure rise characteristic, but gages should be installed and when the total static pressure across the filter exceeds 1 inch (as an extreme maximum) the filters should be replaced or otherwise rejuvenated. It may be necessary also to change the fan speed to overcome the increased resistance in the system but a trial should be made before doing this.

Washer

A cheaper, but not as effective method of recovering the lint may be resorted to as shown in Fig. V. Assuming an air velocity of 500 f.p.m. through the spray section with the nozzle spray properly covering the area and say 2 g.p.m. per square foot per each bank, an appreciable amount of lint will be removed. If water is plentiful the nozzles can be fed direct from the plant supply, but there must also be good drainage available for this scheme. Probably recirculation with a pump and strainer would offer the better solution, a small amount of water being overflowed to remove the surface layer at all times. This method will be further improved in dust removal efficiency by adding an eliminator bank between the spray banks.

Another possibility for this service is the dust separating type fan, but the writer has not had experience with this type of fan on lint service.

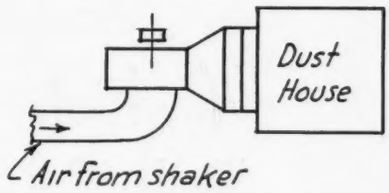


Fig. 1- PLAN

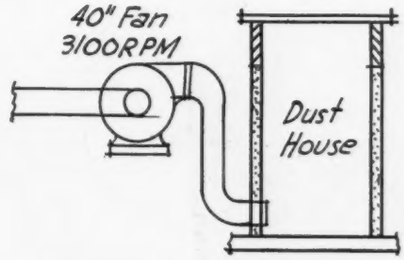


Fig. 2 CROSS SECTION

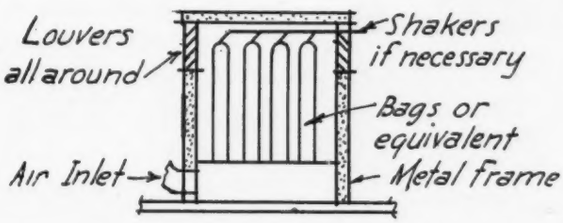


Fig. 3 SECTION - CLOTH FILTER BAGS

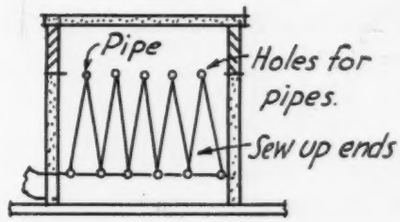


Fig. 3-A SECTION - CLOTH ACCORDION TYPE

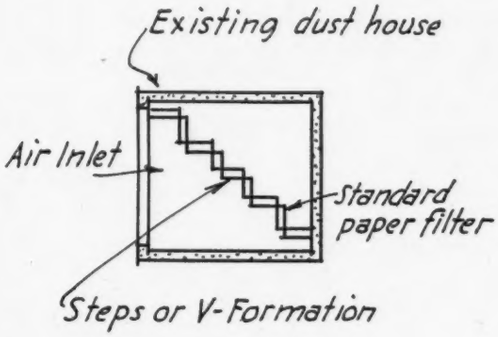


Fig. 4 - PLAN

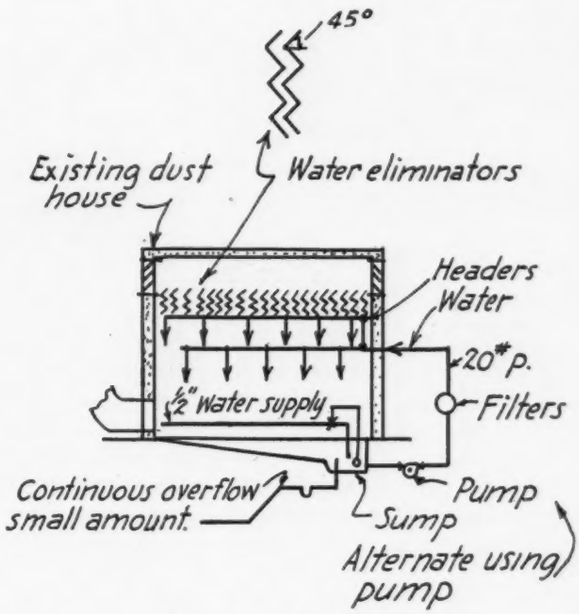


Fig. 5- SECTION

A Table of Models which Built Sales

The signs seem to run downhill (but maybe that's the camera) but the models are exact duplicates of real work the firm does. Placed near the entrances, this table of models shows customers what the sheet metal department can do and calls attention to work which might otherwise be forgotten because the shop is "second floor rear."

By John T. Bartlett

DISPLAY is one of the great modern merchandising principles; and the sheet metal shop can use it, as the sales-building methods of C. J. Osborne, manager of the sheet metal shop of Leffingwell Mercantile Co., Brighton, Colo., proves.

So successful in its first months has been a sheet metal "Model table," constructed by Mr. Osborne, that the plan will be used permanently.

The sheet metal manager took a table 20 inches by 36 inches, and 22 inches high, gave this a sheet metal top, (demonstrating one sheet metal use), then constructed for its sheet metal specialties, in miniature, in wide variety.

He modeled chimney caps—and, within a few weeks, had made several chimney cap sales to customers who, before they viewed the model, had not known that such devices existed! Given a central position was a furnace—big stuff!

Skylights, eave troughs, were shown. There were dust collectors, appealing to the farming district of which Brighton is the center; many farms have grinding mills. With regard to restaurants and other eating places, Mr. Osborne "sampled" a canopy (the ¼-round style). Tool boxes were shown.

Black lettering on metal pieces, soldered to the display, gave necessary explanation. Adding display value to the exhibit, Mr. Osborne built the miniature furnace with a light socket. In this, there is a red bulb, quite powerful. Through five heat pipes, this red light throws out illumination for the entire display—very effective during evening hours, when the store is closed.

During odd times, over ten days, the sheet metal man built the exhibit. The work in it, he says, is equivalent to about two days time.

"Our shop," Mr. Osborne relates, "is located on the second floor at the rear, with an entrance from a side street. I have advertised in the local newspaper, and believe in such advertising, but realized that the shop was not adequately promoted with the large number of people who come every day into the Leffingwell store. The business devoted to hardware and furniture lines, occupies large premises, on the best corner in town.

"We place the table of models near the main entrance, so that practically everyone coming into the store sees it. The men on the floor, if a visitor manifests interest, send the prospect up to me. One of the things the exhibit has shown right from the start is that a great many people are ignorant of the wide variety of work a modern sheet metal shop does.

"I am going to add three new items to the table. One will be a sheet metal drawer. I think I can build up some business in this item. It should interest people who need a drawer which will not be affected by moisture. Also, I shall sample a water trough, and a feed trough, for rabbits."

Mr. Osborne built a sheet metal house for a Christmas display. This house was 18 inches by 30 inches by 15 inches (19 inches to top of roof). The roof was green, balance of house white with green trimmings. The chimney was a red brick effect.

The windows were 4 inches by 8 inches. In the center of one side was the impressive entrance, a mahogany door 6x12 inches, with three small windows in a modernistic effect. Door hardware was a lifelike brass color. There was a small circular platform in front of door.

Social Security—A Brief Outline of Important Provisions

THE last session of Congress passed a general bill entitled the Social Security Act in which there are nine major divisions of Federal, State and combined Federal and State aid to several classifications of persons needing financial relief. While practically every person in the country will be affected, directly or indirectly, by all the nine parts of the bill, one section—unemployment insurance—has already become effective and must be recognized by contractors in the sheet metal, warm air heating, ventilating and roofing industries. The second major section of the act—old age insurance—becomes effective January 1, 1937 and should be prepared for, but can be forgotten except to provide for its adoption when the time comes.

The provisions of the unemployment insurance section became operative January 1, 1936, and taxes to support the measure went into effect January 1, 1936. Briefly here are the major requirements of unemployment insurance.

Insurance Tax

This tax is levied against payrolls and is paid entirely by the employer. Under the Federal law, nothing is paid by the employe toward unemployment insurance.

Who Pays the Tax

A contractor is required to pay the tax if, during the taxable year, he employs eight or more persons on at least twenty different days, each day being in a different calendar week.

The employes do not necessarily have to be the same persons nor do the weeks worked have to be consecutive. To illustrate: If a contractor employs Jones, Smith, Brown, Barry, White, Stone, Andrews and Johnson for a few days each week during March, April and May, then lays these eight men off and later on during the year, he employs eight or more other persons, for at least one day each week during September, October and November, this contractor must pay the Federal tax.

All persons on the payrolls are considered employes—mechanics, shopmen, estimators, bookkeepers, executives, etc.

Rate of Tax

The Federal unemployment tax on payrolls is set at 1% of the total payroll for the calendar year 1936; 2% of the payroll for 1937; 3% of the payroll for 1938 and the years following. In figuring his payroll the contractor must include not only the wages or salary of every employe but also any other remuneration given, such as bonuses, commissions, expenses, allowances for room and board, and the like.

How Federal Tax Is Paid

The payment of the Federal unemployment tax is to be handled much like the Federal income tax now is handled. The tax is to be paid to the Collector of Internal Revenue of the district in which the contractor's place of business is located. Tax returns for 1936 must be filed with the collector on or before January 31, 1937. As in the case of the present Federal income tax, this tax may be paid in quarterly installments.

Tax Credits

If there is no state unemployment act in force in the contractor's own state, the Federal tax will simply be paid in full direct to the Collector of Internal Revenue, as stated.

However, if the state in which the contractor is located has its own state unemployment insurance law which meets the standards set up by the Federal law, the contractor can offer as a credit against the Federal tax, the payments he has made to the state fund for the taxable year, provided such payments have been made to the state before the filing of the Federal return. The credit, however, is allowed only up to 90% of the Federal tax. The remaining 10% for which no credit is allowed, will be paid to the Federal collector and used for Federal administrative expenses and allotted to eligible states for their expenses under the law.

Why State Laws, Too?

The unemployment insurance program, as covered by the Federal Social Security Act, is intended to be carried out by the states. Up to the time of going to press with this issue, six states are reported to have their own state unemployment insurance laws. They are Alabama, California, New Hampshire, New York, Oregon and Wisconsin. Other states are now considering legislation that will conform to the standards set up in the Federal law. If a state has no unemployment insurance law, which meets the Federal standards, that state's citizens derive no benefit from the tax paid the Federal collector.

If a state has an approved law, contractors who are subject to it get relief from the Federal tax by being permitted to deduct from the Federal tax (up to 90%), the payments made to the state fund. Therefore, the likely result of the Federal Social Security Act will be to force all states to pass standard unemployment laws and to require contractors (and other employers, of course), to contribute to the Federal-state plan by paying a small part of their contributions (about 10%) to the Federal government and the larger part (about 90%) to the state.

(*Continued on page* 81)

Skylight Construction

A discussion of the procedure in designing, developing, fabricating and estimating the quantities of materials for several types of skylights in common usage.

By William Neubecker

THE first article to be presented will cover the details of design and fabrication of a flat skylight on a pitched roof as shown in the perspective view in Fig. 1. In the construction of skylights of this type, care must be taken to have the wood or angle iron curb high enough above the roof surface, so that a proper saddle can be built at the upper part of the curb to shed the water to each side as indicated at "A."

The standard type of the skylight bar used, is shown in Fig. 2 by "B." Note how the capping is secured over the glass by means of brass bolts. This is an improvement over the copper cleat method, for the reason, if a light of glass is broken, the cap can easily be removed and again replaced, whereas using the copper cleat, this is liable to break and requires new cleats with loss of time and expense.

When the skylight bars are of long lengths, the section of the bar shown in Fig. 3 is reinforced by inserting a core plate as indicated by "C" and locking an extra wall to the condensation gutter as at "D."

In practice, this wall is first locked as indicated by **i** in the upper sketch, then closed down tight in the brake and turned up to the desired angle shown in the sketch "D."

Fig. 4 shows the construction details and patterns for a flat skylight. The details at the left indicate a section on the line **d-e** in the perspective in Fig. 1 while the section on the line **m-n-o** is shown at the right in Fig. 4.

In designing the sectional views, always keep the glass line of all profiles in one line as indicated. This is very important and facilitates the laying out of the various pattern shapes. When the length of the skylight bars are such that the glass area for each light of glass will be over 570 square inches, it will be necessary to insert a cross bar as shown by **a** in Fig. 1. and detailed in the structural view at the left.

Having all the sectional details in their proper positions, the patterns may now be developed. Take the girth of the common bar in the front section in Fig. 4, from **1** to **6,** and place it on the vertical line above the side section from **6** to **1** to **6°**. Through these points at right angles to **6-6°** draw horizontal lines and intersect them by vertical lines erected from corresponding intersections on the rear and front curbs, all as shown by the dotted lines. Trace a line through points so obtained which will be the desired pattern for the common bar.

As the skylight contains a shoulder of ¾-inch all around the curb as indicated on the rear curb in the side section then the length of the common bar will be 1½ inches shorter than the length of the curb, measuring from the arrow points in the pattern for common bar.

To obtain the pattern for the side curb, take the girth from **1** to **10** in the front section and place it on the vertical line below the side section as shown by similar number **1** to **10.** Through these points the usual measuring lines are drawn and intersected by lines drawn parallel to **1** to **10** from similar intersections on the rear and front curbs as shown by the dotted lines. Connect the various intersections so obtained, then the cut on the right will intersect the front curb and that on the left the rear curb. Allow laps for riveting or soldering purposes as shown by the dotted edges. As the curbs at the sides and top of the skylight have the same profile, then the miter cut from "V" to "W" will also be the miter cut for the rear part of the curb. When laying out the pattern for the side curbs measure from the arrow points shown. When laying out the rear curb pattern measure from arrow point "V" and reverse the cut "V" "W" to the opposite of the desired length. No laps should be placed on the rear curb.

For the pattern for the front curb, take the girth from **1** to **9** in the side section and place it on the vertical line above the front section as shown from **1** to **9.** Through these points draw horizontal lines to the right and intersect by vertical lines drawn from corresponding points in the curb "X." The pattern shape shown is the miter cut used for both sides measuring the desired distance from the arrow.

On the line "Y" weep holes indicated by "W" should be placed in the center of each light of glass to carry off the condensation or leakage from the bars and cross bars.

Referring to the cross bar in the side section, the arrow indicates the pitch or flow of water. The lower light of glass slips into the groove **1** to **4** and the upper light is set in white lead putty along **2-3-5.** Should leakage occur at this joint, it will drip into the condensation gutter **6-7-8,** follow this gutter shown in the front section indicated by the arrow and flow into the gutter of the common bar, which in turn leads the leakage into the curb gutter shown by **5-6** in the side section and out to the roof through the weep holes at **5.**

For the pattern for the cross

(Continued on page 92)

FIG. 2

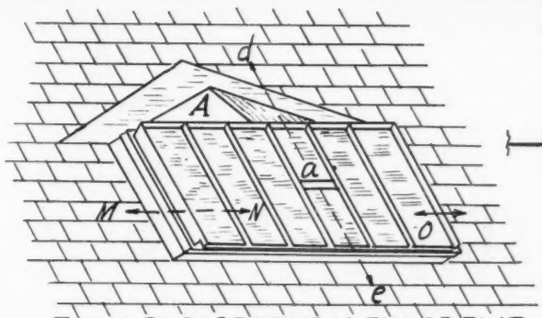


FIG. 1 PERSPECTIVE VIEW OF FLAT SKYLIGHT

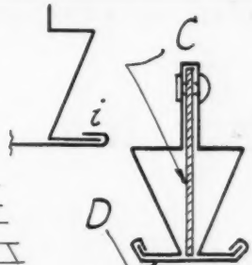
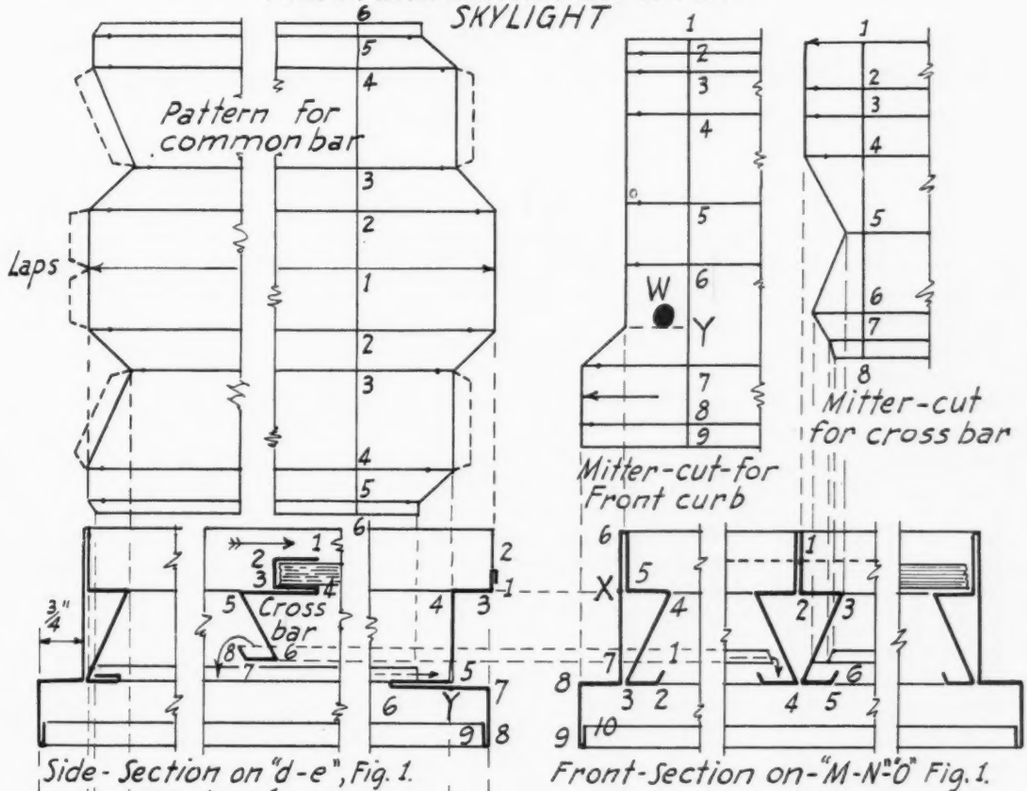


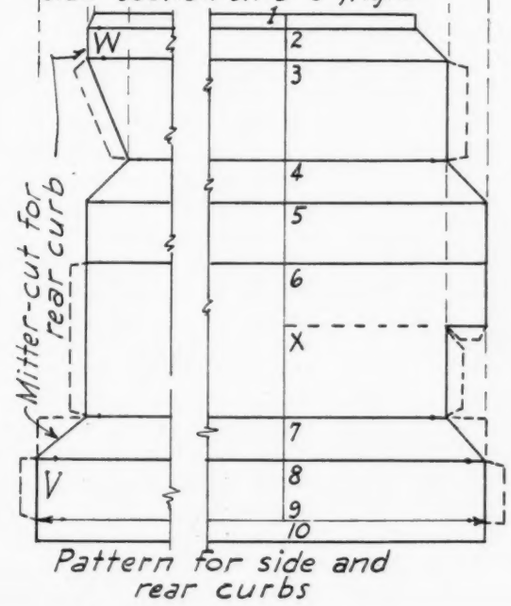
FIG. 3



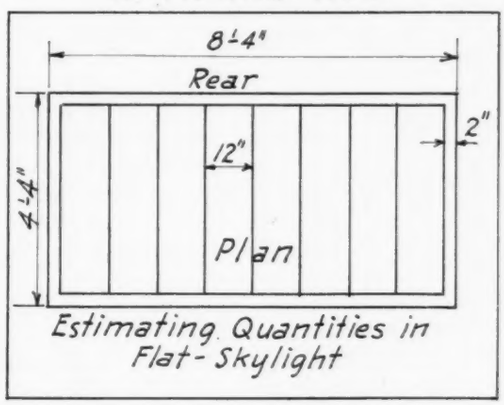
Side - Section on "d-e", Fig. 1.

Front - Section on "M-N-O" Fig. 1.

FIG. 4 CONSTRUCTION DETAILS AND PATTERNS FOR FLAT SKYLIGHT ON PITCHED ROOF



Pattern for side and rear curbs



Estimating Quantities in Flat - Skylight

FIG. 5 PLAN OF FLAT SKYLIGHT

Welding Procedure for the Sheet Metal Shop

A series of practical articles covering accepted welding practice for light gauge sheet and light structural shapes as used in the sheet metal shop for the fabrication of metal specialties, ventilating work, or general architectural practice. This second article discusses types of seams and jigs used in the welding of tanks. The sketches on the opposite page show welds and machines to simplify procedure.

By J. Carl Wilson

IN this article we will deal with tanks and the different types of seams, jigs, etc. The advantages of welding tanks over riveting and soldering, is largely a case of saving in labor. The cost of electrodes will just about offset the cost of rivets and solder, so if we save labor we can make the tanks cheaper.

The following details are some of the designs that the writer has used successfully, but which may be modified to suit the individual shop. The jig or pipe horn for holding and welding round articles, such as tank bodies, pipe, etc., may be made from the scrap pile. This one is made of two pieces of four-inch shelby tubing. The upright piece is welded to a base and bolted to the floor. (Detail B). Then the horn is welded to a collar that will permit raising and lowering the horn, making it possible for the operator to work in a comfortable position.

Horn Design

The horn (see Detail A) has a piece of ¼-inch plate copper, 3 in. by 48 in., formed to fit over the shelby tubing and screwed to the tubing on the sides. The reason for the copper is its ability to absorb heat quickly, permitting fast dissipation of heat from the weld and keeping distortion to a minimum. Also the fused weld metal will not stick or fuse with the copper as it would in the case of an iron backing.

Hold Down Clamp

Hold down clamp (see Detail B) is made of a piece of cold rolled steel stock ⅜ in. x 3 in. x 42 in., hinged at the back end and edged (see Detail A). The front end may have any convenient means of fastening so it will hold the seam close together. In this case we used a tapered piece of steel welded in the front end of horn, a hinged strap with a hole in it welded on the front end of hold-down bar. This strap, when tapped lightly with a hammer, will tighten a seam to make a quick set-up (see Details A and B) note pegs sticking up.

Drill and tap holes in copper for these pegs, spaced one inch closer together than the length of shell or pipe. For 36 in. pipe have pegs 35 in. c. c. These to be ¼ in. x ¾ in. studs tapered so ¼ in. holes in pipe or shell will readily drop over them (see layout Detail H). It is not altogether necessary to have the height of this jig adjustable but this will save time if the work varies much in diameter.

Drawing C, is a 20 BS ga. gasoline storage tank 42 in. x 8 ft. 10½ in. or three 36 in. joints of 42 in. pipe with heads welded in. Detail G, shows the straight seams or shell seams. It is not necessary to make the off-set for this seam any more than that required to give a neat job.

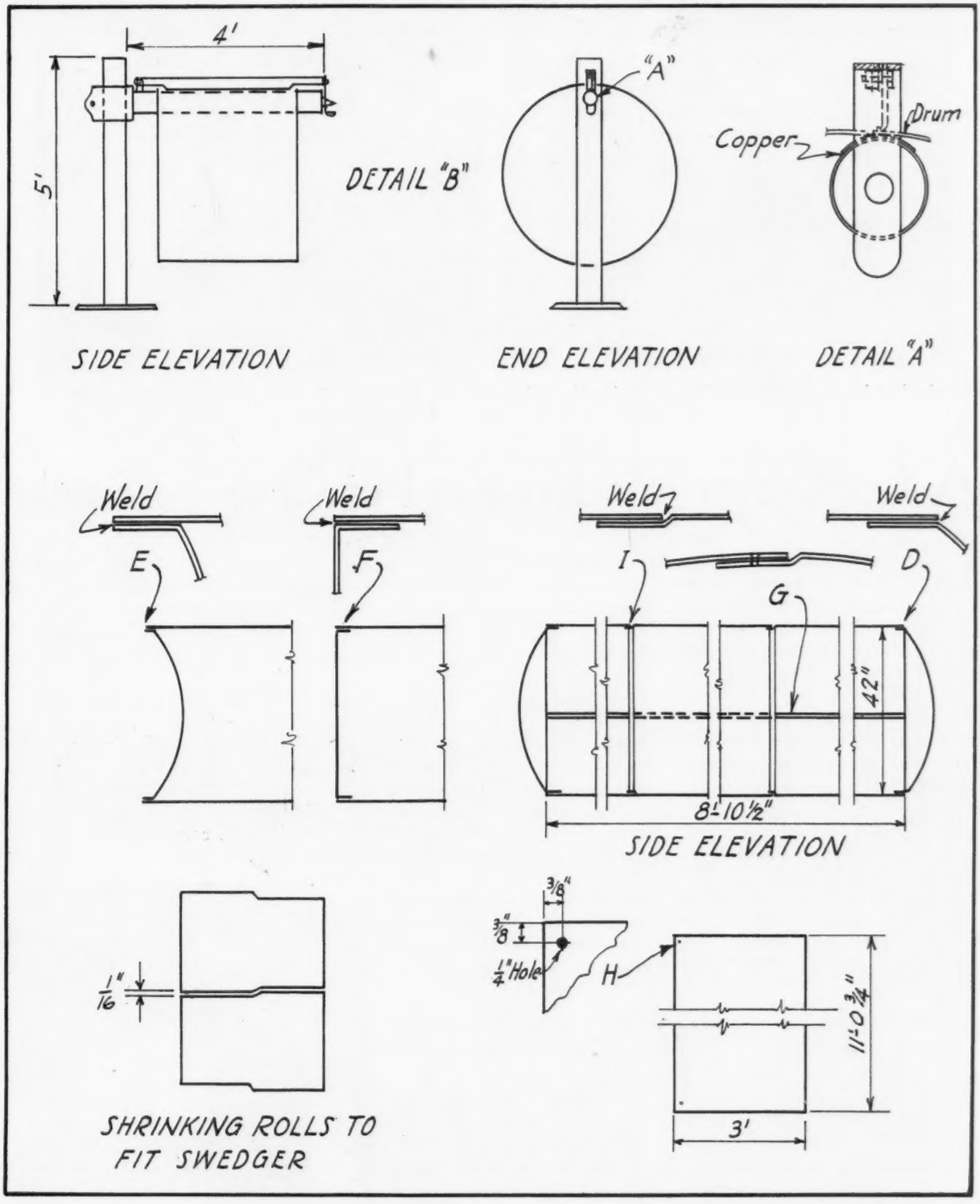
Shell

In laying out the shell (see Detail H), mark and punch four ¼ in. holes ⅜ in. in from edge of sheet these holes to fit over pegs in Detail A and B of jig. This method of putting the shells together will make them all uniform and facilitates assembly. It is well after the shell is clamped in the jig to tack weld the seam about every eight inches to help avoid distortion. This seam is now ready for welding.

Seams

Detail I shows end or roundabout seams. See Detail J for special swedging rolls to shrink ends, these rolls to be made to fit any standard swedging machine. It is better to shrink the end rather than bell it, as the operator has a shoulder to guide him for lap and makes a closer and neater fit. To keep the sections straight, secure a piece of channel iron or H iron that is straight, then push the joints together and drop them in channel. They should line up themselves. Tack weld about every eight or ten inches. Now these seams are ready to weld.

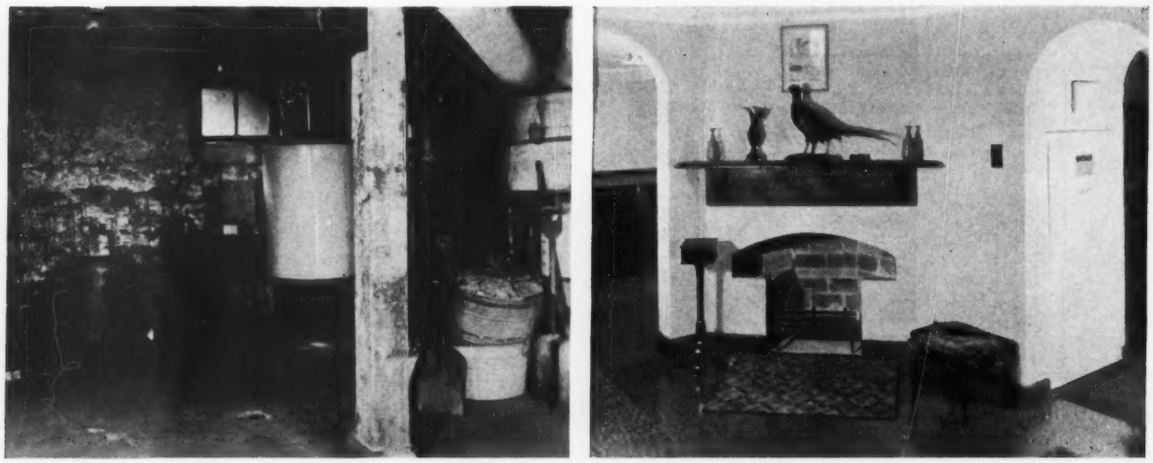
Details D, E, and F, show three types of head seams and point of welding. As much care must be exercised in forming



these heads as is used in riveting, as it is necessary to have as close a fit for welding as for riveting. A little care in fitting will result in a large saving in welding time. Head seam E is recommended when possible, as it is the strongest and best type of seam. D and F, made properly, are good seams and will withstand all of the pressure that a 20 ga. tank should be used for, but require a little more care in welding.

These designs are for tanks 22 ga. to 16 ga. On all work of these gauges a lap seam is recommended, although a butt seam may be used with success, but requires a finer technique than a lap seam. For these gauges of galvanized or black iron, 3/32 electrodes are good and will test above 60,000 lbs. per sq. in. Current 30 to 50 amps., and 60 volts.

See next month's issue for further details on tanks 16 ga. and heavier.



Left—The basement as it "was" (unfinished walls, dark, cluttered). Right—As the basement is now, showing the left side of the fan unit next to the door frame.

A Contractor Modernizes His Own Basement

FRANK E. RUSSEL of the company bearing his name in Cedar Rapids, Iowa, is a contractor who believes in taking his own medicine. Particularly his own heating medicine. That his prescriptions are effective may be judged from the four photographs on this page showing the remodeling work in Mr. Russell's home basement. He says of the job:

"Since you often publish pictures of interesting duct work, I thought perhaps you would be interested in these photos of the heating plant in my basement recreation rooms, which I have just completed. All labor was performed by myself with the aid of members of my own family.

"A square-cased, tubular steel furnace built to my own specifications, a high-low flame oil burner, and a propeller fan-filter unit, furnish completely automatic heat. The use of the fan unit enabled me to run all pipes against the ceiling, saving space and head room. Photo No. 1 gives an idea of the appearance of the basement before work was started. No. 2 is the living room showing the fan-filter unit in hall at right and end of billiard room at left. No. 3 shows front of furnace, built into the wall and warm and cold air pipes against ceiling. No. 4 shows side of furnace with special shaped hood to allow cold air returns from front to come in over the hood to conditioner. The central cold air run comes in from outdoors for use when desired.

"The living room and billiard room are finished in cream colored texture finish plaster. Furnace room and shower in white enameled plaster with tile-effect in shower. A wash room and fruit room complete the suite."

The front of the furnace is practically a flush wall. The front is in the billiard room (shown at the left) while the casing and fan are in the next room. Right—Looking at the fan unit shown above. Note the ducts and the stripped furnace casing.

VOTED

AIR CONDITIONING SECTION

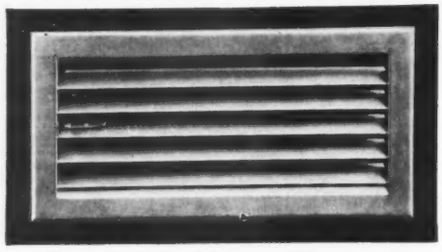
THE article by S. Konzo in this issue is especially recommended because it establishes some new "yard sticks" for estimating the resistance through the duct work. Some entirely new concepts of where resistance occurs and the magnitude of these resistances are pointed out.

- - - There probably isn't a reader who is not deeply interested in better ways to engineer conversion jobs. G. A. Voorhees continues his series on remodeling, this time discussing the problem of handling return air. If you have ever wondered where and why "drafts" you'll like this article.

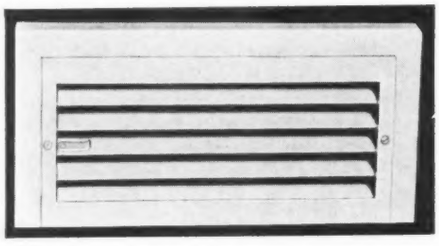
- - - Readers interested in oil burner installations will find some valuable suggestions in the article on the use of smoke pipe dampers to stop furnace heat loss when the burner is idle. The results are plotted to show how this simple remedy saves about 8 per cent of the heat generated.

WATERLOO

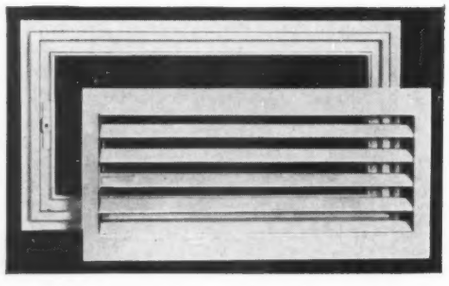
Air Conditioning REGISTERS



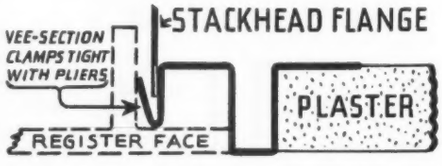
FH-100—Adjustable one-piece Venetian Type Register for walls.



FHD-204—Two-piece Venetian type adjustable register for baseboards.



FH-102—Venetian Type adjustable register for walls, with Vee-U plaster frame.



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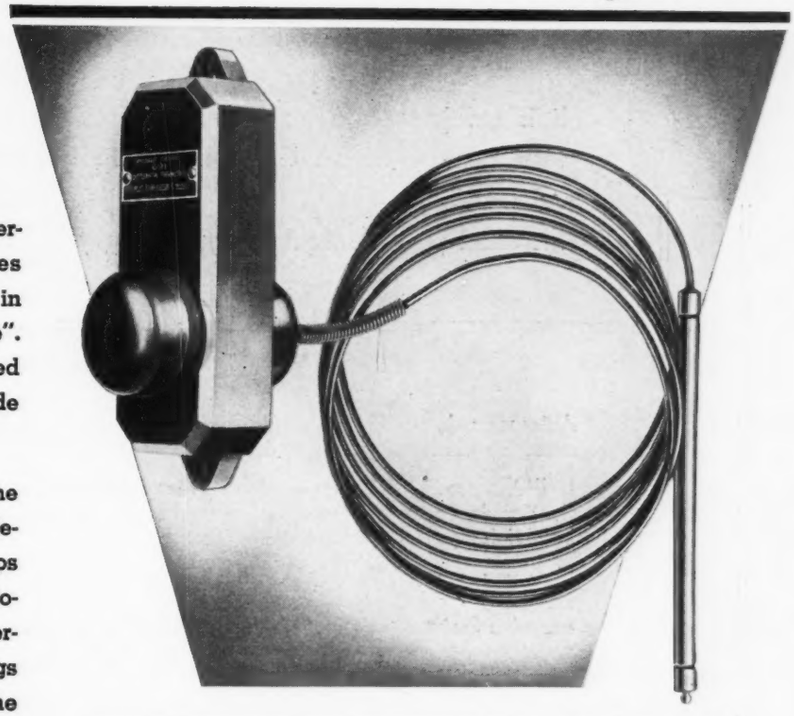

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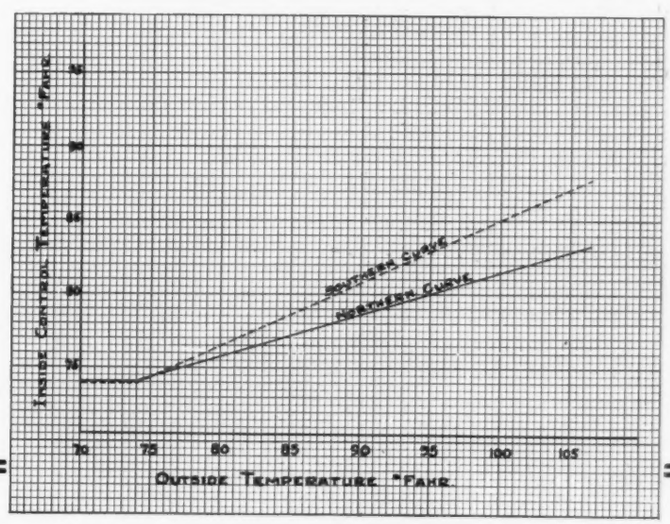

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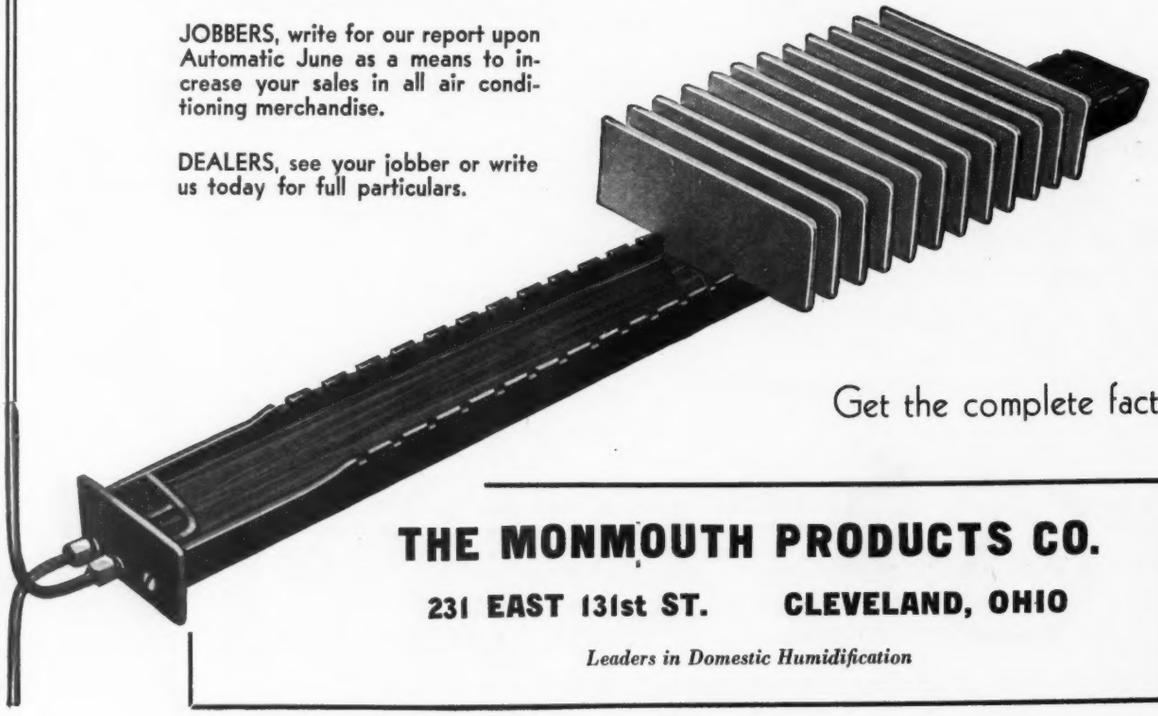

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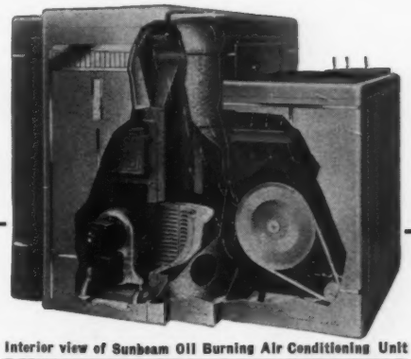

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Oil Burning In Residences‡ [Part 1]

By D. W. Nelson*
Madison, Wis.

OIL burning is a very desirable means of heating residences, because of its automatic temperature control and the almost complete lack of attention required to the heating plant throughout the heating season. In order that oil burning may hold its competitive position in the future with other methods of heating, it will become increasingly necessary to eliminate losses and inefficiencies that result in excessive heating costs.

In the past it is likely that too many installations have been made in a haphazard way. Too often the salesman has been only interested in the placement of the burner and has entirely ignored probable costs of heating. Many burners have been installed in undersized or inefficient boilers or furnaces. In some cases the combustion chamber design has been incorrect and in others the rate of burning has been much higher than required by the heat losses of the residence.

The study in the present paper was made to investigate at least one of the losses and to make a survey of actual installations in residences as to the efficiency of oil burning.

The Investigations

This report is divided into two parts. The first concerns an analysis of losses occurring during off-periods in the operation of intermittent types of burner. The second concerns the results of a survey of a large number of residence installations as to efficiency of combustion as determined by CO_2 and flue gas temperature readings and other related items. The work was done under a project[1] of the Civil Works Administration and later had the assistance of students enrolled under the Federal Emergency Relief Administration.

Most burners work on the intermittent principle. When the call for heat is made the burner starts, and the combustion improves as temperatures increase in the brick work of the combustion space. The burner runs varying lengths of time and makes a varying number of starts depending upon the heat requirements of the building at that time. The newer temperature control systems give very close regulation of temperatures, and the running periods are consequently shorter and more frequent. This tends to increase the off-period losses which result from the cooling off of brick work and heating surfaces with the passage of air through the heating unit while the burner is shut down. Most burners operating on the high-low flame principle are subject to a somewhat similar loss due to a lowered temperature of the combustion space and a larger percentage of excess air during the low flame periods.

Laboratory Investigation

The present study was made on a pressure atomizing burner with positive or fan air supply. The tests were made on a laboratory installation completely equipped for testing and on a residence installation under actual conditions of heating.

Fig. 1 shows a diagrammatic sketch of the laboratory test equipment. The boiler used was a 10-section rectangular cast iron water tube steam boiler having about 87 sq. ft. of heating surface, and was a coal burning type often used for oil burning. With a 2½ gallon nozzle, the maximum load developed was about 850 sq. ft. of radiation. The net combustion space for oil burning was 8 cu. ft.

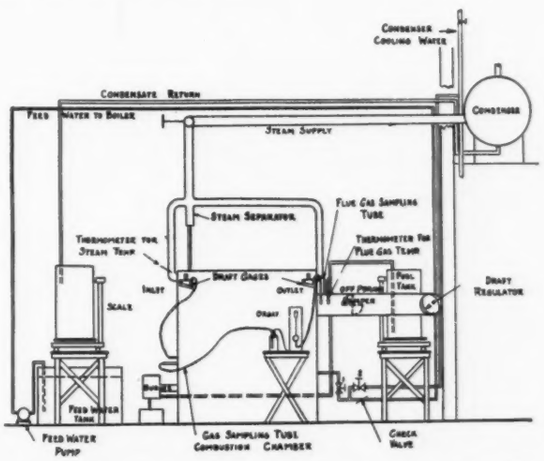


Fig. 1—Arrangement of laboratory equipment to determine off-period losses

For the purpose of these tests a closely fitting damper was placed in the smoke pipe near the boiler outlet. The tests were made to determine the difference in efficiency with various on and off periods for operation with and without the damper. When the damper was kept in the open position at all times, the operation corresponded to the usual method of operation with this type of burner. This was compared with operation when the damper was closed manually as soon as the burner stopped and was opened 1 minute before the burner started. With each of the two types of operation various percentages of "off" and "on" time were tried. The on periods were 10 minutes and the off periods were of varying length. For instance at 50 per cent operating time the burner would be on 10 minutes and off 10 minutes and at 25 per cent operation it would be on 10 minutes and off 30 minutes.

The CO_2 analysis was maintained at 10 per cent with No. 2 distillate fuel burned at the rate of 2½ gallons per hour. The flue gas temperature measured about 450 F. A draft control was used and an effort

---

*Assistant Professor of Steam and Gas Engrg., University of Wisconsin.

[1]The following worked on this project under CWA: W. F. Bakke, E. P. Hansen, L. E. Heger, F. C. Rossow; and the following under FERA: R. H. Amundson, G. W. Androne, H. C. Mittelstaedt, R. H. Newbury, and R. A. Wilson. Project carried on in the Dept. of Mech. Engrg., University of Wisconsin, Prof. G. L. Larson, Chairman.

‡Presented at the Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, Toronto, Ont., Can., June 1935.

was made to maintain 0.02 in. in the combustion space. Due to the windy weather at the time of some of the tests and to an oversize chimney, difficulty was experienced in holding this steady and as a consequence it was found difficult to always get consistent results. A draft regulator was used at the location shown in Fig. 1.

The results of the tests are shown on Fig. 2 for both types of operation. The maximum efficiency secured at continuous operation was 66 per cent. The CO_2 determination of 10 per cent and the boiler outlet temperature of 450 F. indicates an efficiency of 82.5 per cent. The reason for this difference of 16.5 per cent is not known. The stack gases were not analyzed for unconsumed hydrogen or hydrocarbons. It

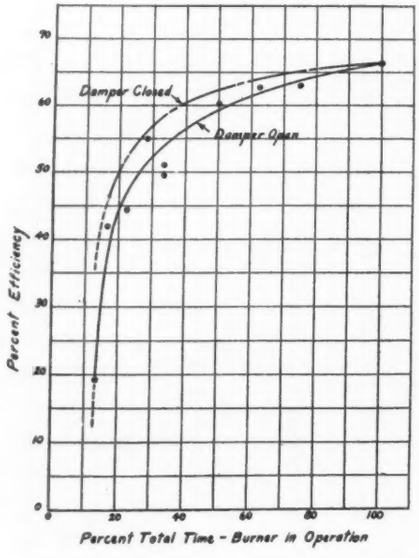


Fig. 2—Comparison of efficiency with and without the off-period damper

is suspected that the heat loss to the base and floor was large as the combustion space was partly below the water cooled surface of the boiler. This arrangement was made because of a drop section in the boiler useful in connection with the hand firing of bituminous coal. This loss might have been reduced by the use of insulation between the bricks and concrete base and floor or by the use of insulating bricks.

With the interpretation of the test results as made by the placement of the two curves of Fig. 2, the saving due to the use of the damper appears as the vertical distance between the two curves. These differences plotted on Fig. 3 show the greatest saving for the damper for the shortest periods of operation. It would seem for best efficiency that the burner should operate almost continuously under maximum heat requirements. In this locality the average load is about one-third the maximum. This indicates an average loss of about 9 per cent that might be eliminated by the prevention of air circulation through the combustion space during off-periods.

The second part of this study of the off-period loss was made in a residence heated by a pressure atomizing burner installed in a rectangular steam boiler of 8 sections. The system was a one pipe system with vacuum vents and the connected load was about 350 sq. ft. EDR. The boiler catalog rating for coal burning was 900 sq. ft. and the net rating would be about 450 sq. ft. The rate of oil burning was 1.8 gallons per hour which resulted in a boiler stack temperature from about 500 F. to 550 F. The draft regulator setting was kept constant on all tests. A fuel burning rate of 1.8 gallons per hour gives ample capacity for the warming up period in the morning when operated on dual (lower night temperatures) control. The system operates on pressure control for several hours during the warming up period in cold weather indicating sufficient burner and boiler capacity, but this does indicate insufficient radiation for this type of operation. Heat loss calculations indicate the installed radiation as being sufficient to meet the maximum losses but there is no reserve for rapid heating up after the temperature has been allowed to drop to 50 F. One downstairs radiator was not used during these tests.

The use of oil was measured by totalling the hours of burner operation by a self-starting electric clock

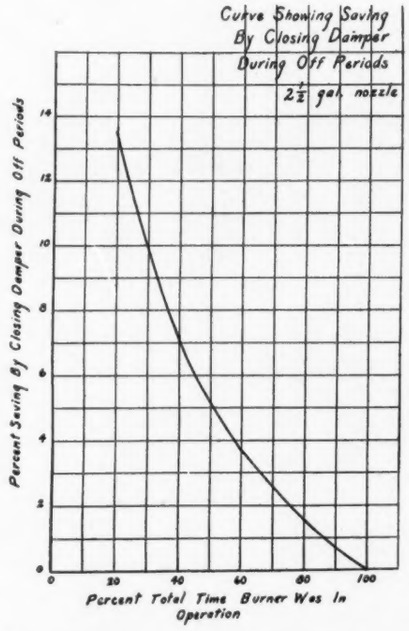

Curve Showing Saving By Closing Damper During Off Periods
2½ gal. nozzle
Percent Saving By Closing Damper During Off Periods
Percent Total Time Burner Was In Operation

Fig. 3—Savings resulting from the use of the off-period damper at various percentages of running time

placed in the burner-motor circuit so that it started and stopped with the burner. Since the oil temperature was practically constant because an inside oil tank was used and also since the same nozzle and the same atomizing pressure was used on all tests, the running times gave an accurate determination of oil use. An accurate fluid column gage on the tank was used as a check and the rate of consumption of 1.8 gallons per hour was obtained by this means.

An automatic damper was installed in the smoke pipe near the boiler outlet. The damper was operated by an electric motor similar to that used for operation of draft dampers on hand-fired installations arranged for thermostatic control. The room thermostat caused this motor to open or close the damper to suit the de-

mands for heat. The oil burner was controlled through this damper by switches of the mercury type attached to its shaft. Whenever the damper was in the open position, the burner controls caused it to start and when the damper motor caused the damper to begin to close, the controls stopped the burner. The cycling controls of the burner allowed about a minute between the damper assuming the open position and the starting of the burner. The early breaking of the burner motor circuit upon the turning of the damper from the open position and the slow operation of the damper motor gave considerable time for burnt gases to be cleared from the combustion chamber at the close of a period of operation.

Tests with one system of operation were usually made over a period of a week and a sufficient number of days were taken to eliminate to some extent the variable factors of sun and wind effect which in addition to temperature differences influence the heat losses. The effect of the damper on the amount of fuel used was observed with continuously maintained inside temperatures and with dual or lowered night temperatures.

The results are shown in Fig. 4 for a continuously maintained temperature of 70 F. and in Fig. 5 for daytime 70 F. and night thermostat setting of 50 F. The outside temperatures, wind velocities and sun intensities shown on these figures are averages of readings secured from the local Weather Bureau Station.

The data on Fig. 4 show that the weather conditions were quite similar in the two periods of tests for continuous control. During the 18 days of tests with the damper in use, the temperature averaged 24 F., the wind velocity 10 m. p. h. and the sun effect 206 calories per sq. cm.

During the 13-day period without the damper in use, the temperature averaged 1 degree lower, the wind velocity the same, and the sun intensity 99 calories per sq. cm. The running time with the damper in use was 5.8 hours per day and without the damper was 6.5 hours per day. When the correction is made for the 1 degree difference in temperature, the saving is 8.9 per cent. This saving in running time shows as the vertical distance between the two curves on Fig. 4 at 23 F. The sun intensity variation favored the period when the damper was in use which indicates that the real saving was somewhat less than 8.9 per cent. The

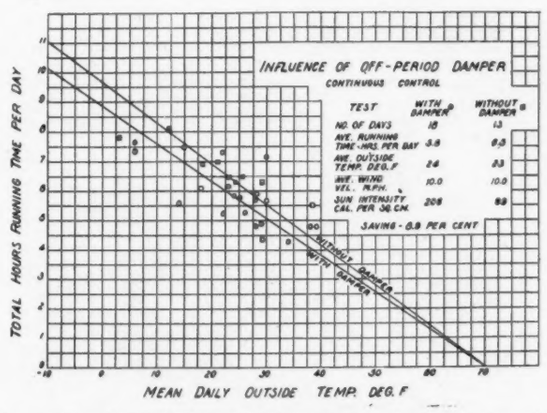


Fig. 4—Results of off-period damper tests in residence with continuously maintained temperature of 70 F

scattering of the points of daily average temperature and the hours of burner operation can be explained when the sun intensities and wind velocities of individual days are examined. A point above the line is almost always a windier-than-average day and a point below is a sunnier-than-average day.

The similar comparison of damper operation when carrying reduced temperatures at night time from 10:30 p.m. to 5:45 a.m. indicated a saving of 7.2 per cent as shown on Fig. 5. In these tests of 32 days with the damper, and 45 days without the damper, the sun intensities and wind velocities varied a slight amount, but in directions tending to balance each other so that probably these factors have not appreciably influenced the results. The temperature averages differed by 13 F., being 20 F. for the period with damper use and 33 F. without the damper. The carrying of lowered temperatures at night times does make a saving which differs at various outside temperatures. This influences the results of this damper study since the average outside temperature differed by 13 F. in the two periods. The saving due to such dual control must result from smaller temperature differences. In

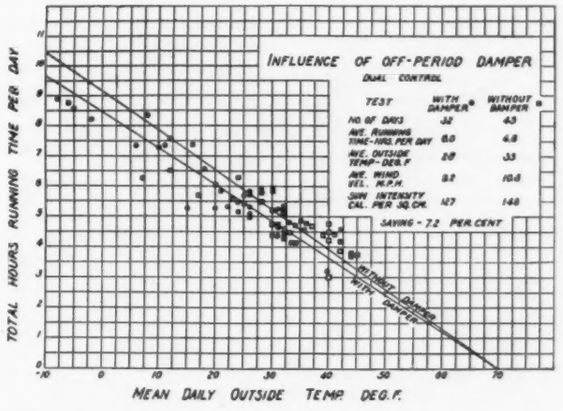


Fig. 5—Results of off-period damper tests in residence with lowered night temperatures

this study of an off-period damper, the average running time of 6.0 hours at 20 F. was corrected to 33 F. by a ratio of temperature differences inside to outside with 20 F. weather to temperature differences inside to outside with 33 F. weather. In order to obtain these differences the inside room temperatures were averaged by hours for each condition from recording charts. The curves on Fig. 5 as on Fig. 4 were drawn as straight lines through 70 F. and a point established by the average running hours and the average outside temperature. The saving is approximately the vertical difference between the two curves at 33 F.

The saving found by the use of the damper was 7.2 per cent for dual temperature control and 8.9 per cent for continuous control. The latter figure is considered somewhat high because of differences in sun effects and the 7.2 per cent is considered somewhat low because of the method of damper operation.

The room thermostat controlled the operation of the damper. During the warming up period each morning,

(*Continued on page 62*)

Forced Air Heating Facts From the Research Residence

By S. Konzo
Special Research Associate
Engineering Experiment Station
University of Illinois

In this article the author has attempted to correlate material from various sources bearing on the subject of resistance to flow of air.

Frictional Resistance of Ducts and Elbows

IN the January, 1936, article a condensed table listing pressure losses for various parts of a forced-air duct system was presented, together with a method for making estimates of pressure losses in an actual duct system. In this article data will be presented that should prove of especial interest to the installers of sheet metal duct work and the designers of a heating plant. The material has been obtained from a great many sources and in some cases has been replotted or simplified for the purposes of this article.

Friction Loss in Ducts

A table giving the frictional resistance of ducts to air flow was shown in a previous article, January 1936, and is reproduced in this section as Table 1.

An example showing the method to be used in calculating frictional resistance in ducts will be followed by a simplified explanation of the friction chart.

Examples

A. Given a duct of the following specifications:
1. Size = 8 in. x 16 in.

TABLE 1

Pressure Losses in Ducts Inches of Water

Air Velocity Ft. per Min.	200	400	600	800	1000
Equivalent duct diam. in inches	Frictional loss for 100 ft. of duct				
6	0.02	0.08	0.16	0.27	0.41
7	0.02	0.07	0.13	0.22	0.33
8	0.02	0.06	0.11	0.19	0.28
9	0.02	0.05	0.09	0.16	0.24
10	0.01	0.04	0.08	0.14	0.22
11	0.01	0.04	0.07	0.13	0.19
12	0.01	0.03	0.07	0.12	0.17
13	0.01	0.03	0.06	0.10	0.15
14	0.01	0.03	0.05	0.09	0.14
16	0.01	0.02	0.04	0.08	0.12
18	0.01	0.02	0.04	0.07	0.10

2. Length = 46 ft. straight run, two 90-degree elbows.
3. Velocity = 600 feet per minute.

B. In order to find the frictional resistance of the duct, it is necessary to know the following two factors, which are listed in Table 1 and in the usual friction chart.

4. Equivalent duct diameter for an 8 in. x 16 in. duct is 12.3 inches. See Table 1a, which is the standard round-rectangular pipe friction equivalent table. Follow left-hand column down to 16 and then across to column headed by 8 to obtain the value of 12.3 inches.

5. Equivalent length of duct for a 46-foot straight run and two 90-degree elbows can be determined by obtaining the equivalent length of the elbows. In other words, the question can be stated as: "The frictional resistance of one right angle elbow is equivalent to how many feet of straight pipe?" In this example, the resistance of each elbow is assumed as equal to seven feet of straight pipe. A detailed explanation of elbows will be given in a later section of this article.

The "equivalent length of duct" is obtained by adding the two equivalent lengths of seven feet to the straight run of 46 feet to obtain a total of 60 feet.

C. The determination of frictional resistance from Table 1 is made in the following manner: Follow the

TABLE NO. 4

EQUIVALENT ROUND AND RECTANGULAR DUCTS FOR EQUAL FRICTION

Sides of Rect. Duct	Diameter of Equivalent Round Pipe																		
	2½	3	3½	4	4½	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
8	4.7	5.2	5.7	6.1	6.5	6.9	7.6	8.2	8.8											
8½	4.9	5.4	5.9	6.3	6.7	7.1	7.8	8.5	9.1	9.6										
9	5.0	5.5	6.0	6.5	6.9	7.3	8.0	8.7	9.3	9.9										
9½	5.1	5.7	6.2	6.6	7.1	7.5	8.2	8.9	9.6	10.2	10.7									
10	5.2	5.8	6.3	6.8	7.2	7.7	8.4	9.2	9.8	10.4	11.0									
10½	5.4	5.9	6.5	7.0	7.4	7.8	8.6	9.4	10.0	10.7	11.3	11.8								
11	5.5	6.0	6.6	7.1	7.6	8.0	8.8	9.6	10.2	10.9	11.5	12.1	12.6							
11½	5.6	6.2	6.7	7.2	7.7	8.2	9.0	9.8	10.5	11.2	11.8	12.4	12.9	13.4						
12	5.7	6.3	6.9	7.4	7.9	8.3	9.2	10.0	10.7	11.4	12.0	12.6	13.2	13.7						
12½	5.8	6.4	7.0	7.5	8.0	8.5	9.4	10.2	10.9	11.6	12.2	12.9	13.5	14.0						
13	5.9	6.5	7.1	7.7	8.2	8.7	9.6	10.4	11.1	11.8	12.5	13.1	13.7	14.3						
13½	6.0	6.6	7.3	7.8	8.3	8.8	9.7	10.6	11.3	12.1	12.7	13.4	14.0	14.6	15.1					
14	6.1	6.7	7.4	7.9	8.5	8.9	9.9	10.8	11.5	12.3	12.9	13.6	14.3	14.9	15.4					
14½	6.2	6.8	7.5	8.1	8.6	9.1	10.1	11.0	11.7	12.5	13.2	13.9	14.5	15.1	15.7	16.2				
15	6.3	6.9	7.6	8.2	8.7	9.2	10.2	11.1	11.9	12.7	13.4	14.1	14.7	15.3	16.0	16.5				
15½	6.4	7.0	7.7	8.3	8.9	9.4	10.4	11.3	12.1	12.9	13.6	14.3	14.9	15.6	16.2	16.8	17.3			
16		7.1	7.8	8.4	9.0	9.5	10.5	11.4	12.3	13.1	13.8	14.5	15.2	15.8	16.5	17.1	17.6			
17		7.3	8.1	8.6	9.2	9.8	10.8	11.8	12.6	13.5	14.2	15.0	15.7	16.3	17.0	17.6	18.2	18.7		
18			8.2	8.8	9.5	10.0	11.1	12.1	13.0	13.8	14.6	15.4	16.1	16.8	17.4	18.1	18.7	19.2	19.8	
19				9.1	9.7	10.3	11.4	12.4	13.3	14.2	15.0	15.8	16.5	17.2	17.9	18.5	19.2	19.8	20.4	20.9

Table 1A—The standard round-rectangular pipe friction equivalent table.

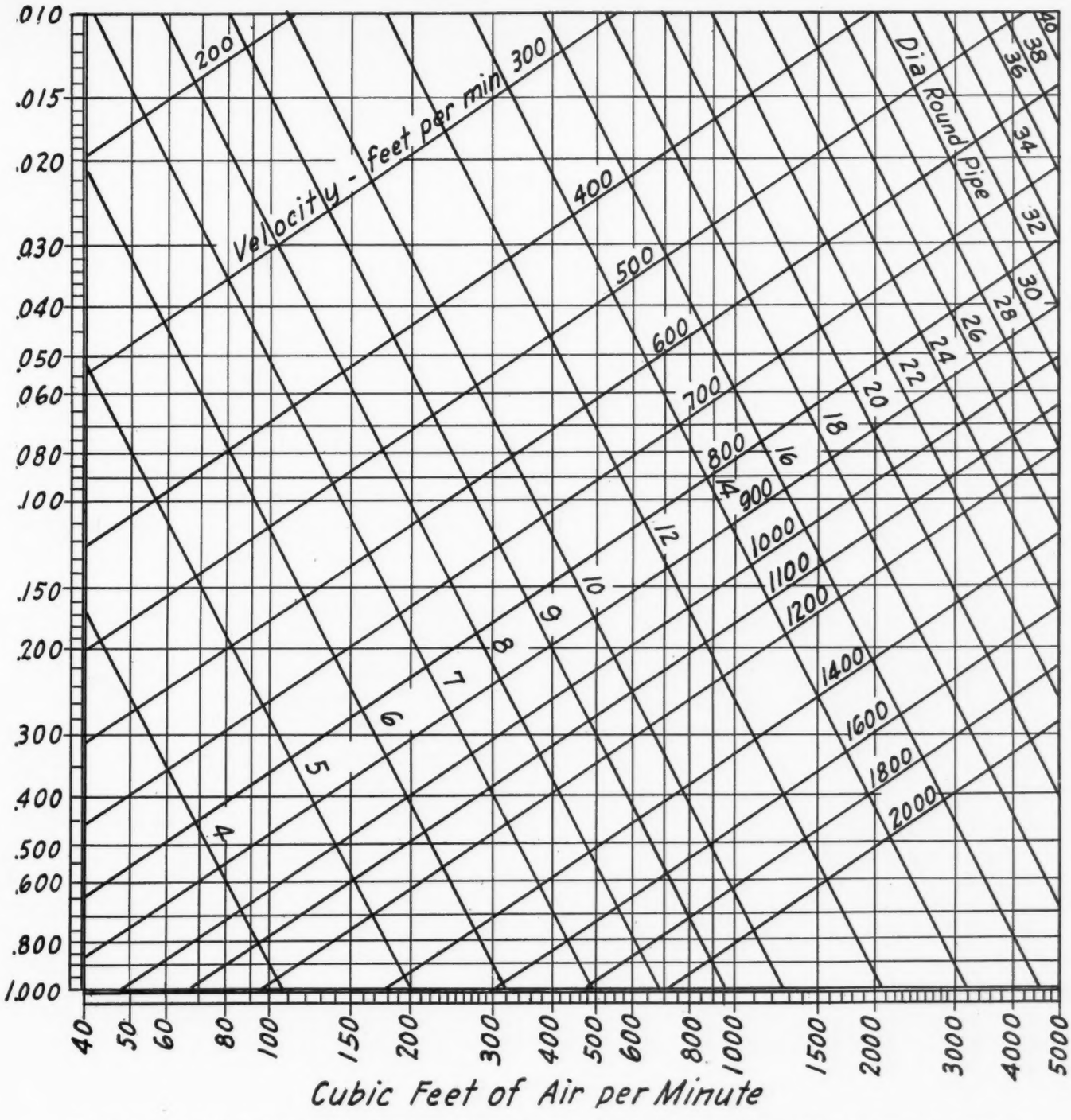


Fig. 1—Revised friction chart, originated and copyrighted by G. A. Voorhees with special provision for low c.f.m. and low pressure losses. See Figs. 2 and 3 for simplified diagrams.

left hand column down to "12," and then across to the column headed by "600 ft. velocity." The frictional loss is 0.07 in. per 100 ft. of duct.

In the example, the duct length was only 60 ft. Therefore, the frictional resistance of the given duct is equal to 60 per cent of 0.07 in. or 0.042 in. (.07 times .60.)

The Friction Chart

The same values which are listed in Table 1 can be represented in the form of a chart, which is referred to as the "friction chart." A typical chart of this type is shown in Fig. 1.

It should be especially emphasized that the friction loss per 100 ft. of duct, as determined from charts of this nature, is absolutely dependent on the value assigned to the "coefficient of friction" in the construction of the particular chart used. The friction charts ordinarily used in practice are usually based on a friction coefficient of 0.0062, with air at a temperature of 70 degrees F. and a pressure of 29.92 inches of mercury. A survey of the best experimental evidence indicates a value of 0.0050 for air flowing in smooth 9 in. x 14 in. ducts at a velocity of 800 ft. per min. The usual chart, therefore, provides a safety factor of approximately 25 per cent. In the average small duct

installation, with its short length of ducts, a greater factor of safety may prove desirable in order to compensate for the shock losses introduced in such systems by dampers, projections, and joints.

The usual friction chart is extremely confusing to those who are not accustomed to a chart in which four separate ordinates are used. For purposes of explanation the writer presents two simplified diagrams which show the essential features of the friction chart.

In Fig. 2 all the lines representing diameter, except that representing the 10-in. diameter, have been removed. The arrows in the figure indicate the steps involved in obtaining the friction loss per 100 feet of duct for a 10 in. diameter pipe carrying 500 cubic feet per minute. It may be noted that the value for friction loss is 0.175 in. of water for 100 ft. of duct. In a similar manner the friction loss for the 10 in. pipe may be determined for 1000 cu. ft. per minute or for 200 cu. ft. per minute by following the proper values listed along the horizontal axis.

Now, in a pipe 10 in. in diameter, (cross-sectional area of 0.545 sq. ft.) conveying 500 cu. ft. of air per minute, the air will be travelling along the pipe at an average velocity of 500/0.545 or 918 ft. per minute. The intersection of the line representing the "10 in. diameter pipe" with the line representing "500 cubic feet per minute" therefore is equivalent to 918 on the "velocity scale" as shown in Fig. 3. The velocity scale was calculated in the manner indicated and combined with the essential values shown in Fig. 2 to obtain the composite chart, which is designated as the friction chart as shown in Fig. 1.

Friction of Elbows

Experimental work in the determination of the loss of pressure due to elbows in the transmission of air through ducts has not been plentiful, and the results obtained have not all been in agreement. The research project which is to be started by the laboratory of the American Society of Heating and Ventilating En-

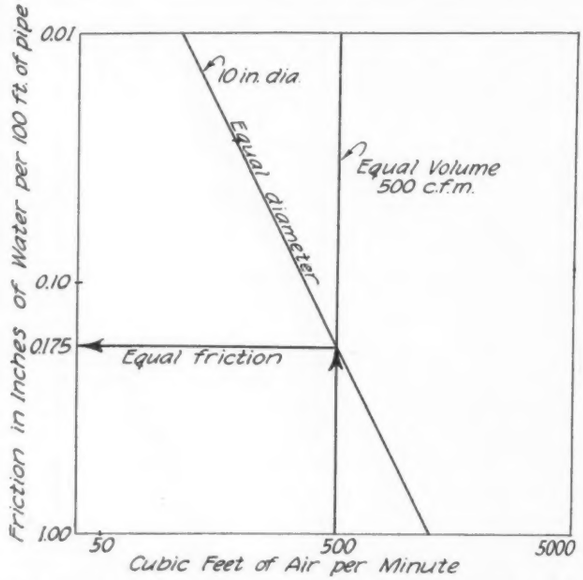


Fig. 2—Simplified line diagram of friction chart. A 10-inch diameter pipe conveying 500 c.f.m. has a pressure loss of 0.175 inch per 100 feet.

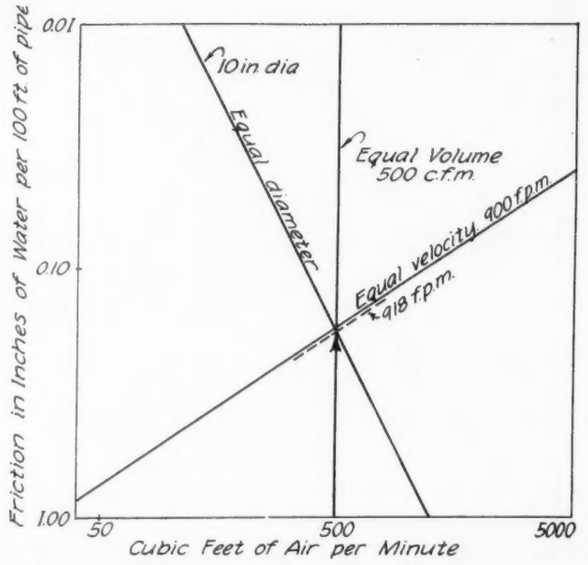


Fig. 3—Simplified line diagram of typical friction chart. See also Fig. 2. A 10-inch pipe conveying 500 c.f.m. moves the air with an average velocity of 918 feet per minute.

gineers will no doubt provide basic data of interest on the subject.

The writer has presented in tabular form the results published, by Frank L. Busey in the 1913 A.S.H.V.E. Transactions, by William D. Edwards in the Heating and Ventilating Magazine February 1928, and by Karl E. Kirkwood in "The Sanitary Age, December 1936." It should be noted that the pressure less has been ex-

(*Continued on page* 56)

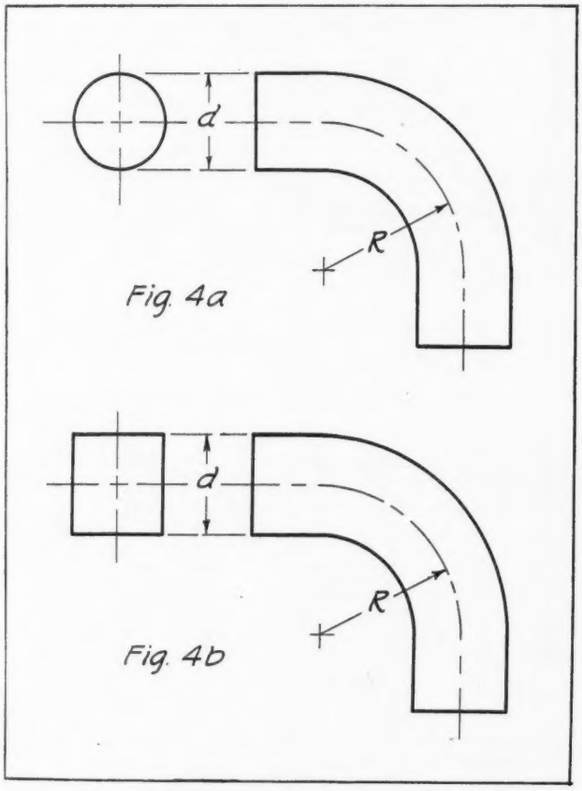


Fig. 4—Dimensions of round and square elbows and satisfactory radii. See Tables 2 and 3.

Control Methods for Domestic Conversion Gas Burners*

[Part 3]

By L. C. Price

Research Associate Professor of Mechanical Engineering, University of Arkansas

Conduct of the Tests

THE standard method of testing heating boilers as specified by the American Society of Heating and Ventilating Engineers was followed as closely as possible. The principal object in each test was to get reliable data for plotting a curve of hourly fuel consumption versus boiler output.

Before each test, a preliminary run was made, during which the flow rates of gas and air were adjusted for best efficiency under continuous operation at the rated boiler output. Thereafter, under intermittent control, the gas and air adjustments were not changed, and lighter loads were established by throttling the steam discharge so that the automatic control turned the gas on and off as needed to maintain the pressure. Under throttling control, adjustments of both gas and steam were manual, and were so coordinated as to maintain an average gauge steam pressure of about three pounds per square inch.

Each test was made up of a series of runs, each run at a different load. The loads varied from zero to the full boiler rating for tests Nos. 1 and 2, and from zero to half rating for Nos. 5 and 6. With the throttling control it was never possible to get down to zero load, but that point was approached as nearly as possible. Otherwise the load range with throttling control was the same as with the intermittent type. The minimum length of each run was two hours; if at any time the data seemed inconsistent, the length of that run was extended.

Both gas meters were read at the beginning and end of each run, and the net readings were averaged to determine the consumption.

Every half hour during each run an analysis was made of the flue gas to determine the volume percentages of CO_2, oxygen, and CO, and readings were taken of steam pressure and the temperatures of the feed water, stack gases, and room. These values were averaged for each run, and the final results were calculated from these averages.

At the beginning of each run the level of water in the feed tank was brought up to a gauge mark therein. Water in the supply tank was then weighed. This procedure was repeated at the end of each hour during the run. The difference between successive weights of the supply tank was, of course, the weight of water evaporated during the hour.

Calculation of Results

The results of the individual tests were calculated in the usual way, and need no comment. They are shown in graphic form in Figs. 3 and 4. These are the curves for only one of the burners tested. They are, however, typical of all, so that the rest have been omitted.

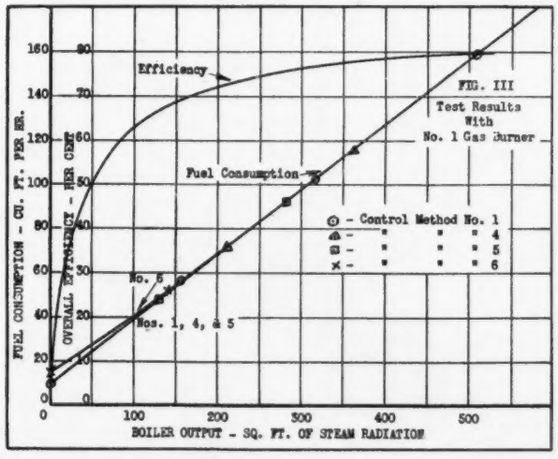

Efficiency
FIG. III
Test Results With No. 1 Gas Burner
Fuel Consumption
⊙ - Control Method No. 1
△ - " " " 4
□ - " " " 5
× - " " " 6
No. 6
Nos. 1, 4, & 5
FUEL CONSUMPTION - CU. FT. PER HR.
OVERALL EFFICIENCY - PER CENT
BOILER OUTPUT - SQ. FT. OF STEAM RADIATION

Fig. 3—Fuel consumption of four types of control plotted against efficiency. To get seasonal consumption the consumption for any particular control was multiplied by 5260 (see text).

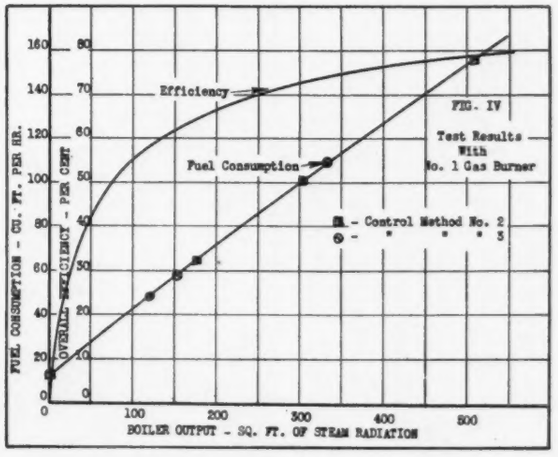

Efficiency
FIG. IV
Test Results With No. 1 Gas Burner
Fuel Consumption
⊙ - Control Method No. 2
⊙ - " " " 3
FUEL CONSUMPTION - CU. FT. PER HR.
OVERALL EFFICIENCY - PER CENT
BOILER OUTPUT - SQ. FT. OF STEAM RADIATION

Fig. 4—Consumption chart similar to Fig. 3, but for two control methods. Compare with table at end of article.

The seasonal fuel consumption for the heating plant with each burner and each control method was calculated on the basis of a 21.6 per cent average load factor for the heating season. This figure is correct for Fay-

(*Continued on page* 54)

**Published as Bulletin No. 12, Engineering Experiment Station, University of Arkansas, Fayetteville, Arkansas.*

An Oil Fired Incorporates Latest

This complete winter-summer air conditioning system is typical of the better residential work being installed in Detroit. As shown at the left the furnace is modern (Bertossa Power Heater) matched oil burner (Century) compressor is under the stairs, blower, filter, cooling coil are behind the heater.

IN the city of Detroit and its suburbs home building has been active during the most part of 1934 and all through 1935, permits showing a general average rate of construction of about 200 houses per month. Selling prices range from $7,000 to $15,000 which, under Detroit materials and labor prices, means a substantial building of frame or brick veneer, on a fair sized lot, in a good locality.

Equally interesting is the fact that well over 90 per cent of all these houses have been heated by forced, warm air with probably 60 to 70 per cent using oil for fuel. Concurrently with this substantial program of medium-priced houses there has been noticeable activity in the construction of larger houses—structures costing from $25,000 to $100,000. And, like the homes in the lower priced bracket, these large houses have also been preponderantly forced warm air, oil fired, with many incorporating provision for summer cooling.

The general design of the systems in the larger houses is well portrayed by the description and illustrations of the installation presented in this article detailing an outstandingly successful installation in the home of B. S. Austin. The exterior view shows a house of 38,000 cubic feet of heated space; of stone and stucco construction; placed well back on a large wooded lot; garage enclosed in the house and heated; recreation room, halls, bath, and heated basement.

The system was engineered by H. Bertossa, designer of the furnace and was installed by the Nelson Company, licensed manufacturers of the furnace.

The system is designed to supply forced, filtered, humidified warm air in winter and circulated, cooled, filtered air in summer. The heating requirements are 320,000 B.t.u. per hour at an 80-degree temperature rise. The steel furnace is designed for oil burning and has a matched pressure atomizing burner. The circulating unit contains filters and sprays and delivers 3,800 c.f.m. or 6 air changes per hour. The furnace has a rating of 350,000 B.t.u. per

Photographs of four interesting rooms and the even more interesting special grills. From left to right—dining room, wood-paneled living room, glass and mirrored sun room, basement recreation room.

Installation Which Comfort Features

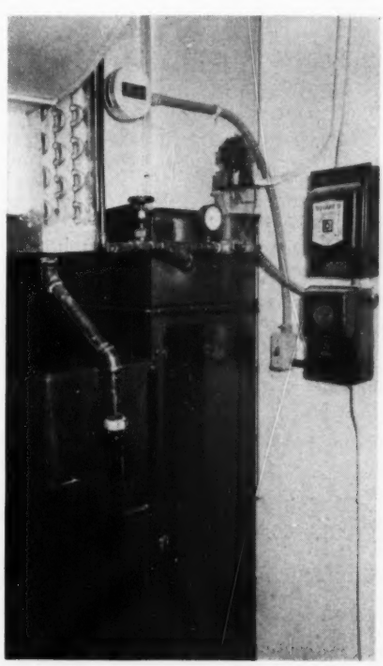
hour and the blower 5,000 c.f.m.—both units having surplus capacity for unusually severe weather.

The basement piping plan and the floor plans show a distribution system divided into two zones. Zone 1 serves the first floor and garage. Zone 2 serves the entire second floor. The supply piping is divided at the heater for the two zones. One thermostat on the first floor and another on the second controls each respective zone. Zone 1 thermostat is in the living room; zone 2 thermostat is in the master bed room—these rooms being selected as typical of heat losses, heat gains, air movement, recirculation and because they are important areas. A motor driven master damper in each main supply trunk shuts off and opens each zone on command of the zone thermostat.

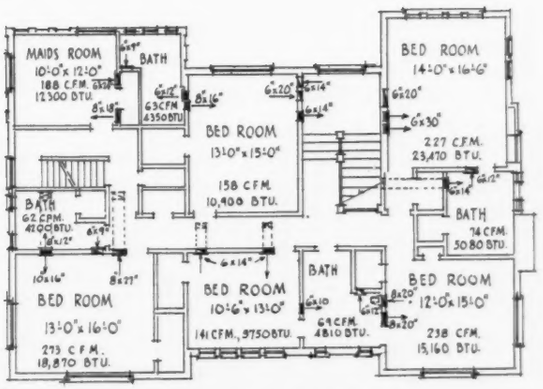
Among the interesting features of the installation is the high velocity (1200 feet per minute) used in the mains and in several of the risers and branches. Enlargement of the riser just behind the register lowers the velocity to 350 to 450 feet per minute. Four of the photographs show some of the special register faces especially designed for the particular room. The dining room, living room and sun room are particularly good examples of these special faces. In most of the rooms returns are located in the baseboard, while registers are in the high side walls.

Particular attention was given the problem of getting complete warm air distribution in every corner of every room. This frequently necessitated

(*Continued on page* 48)

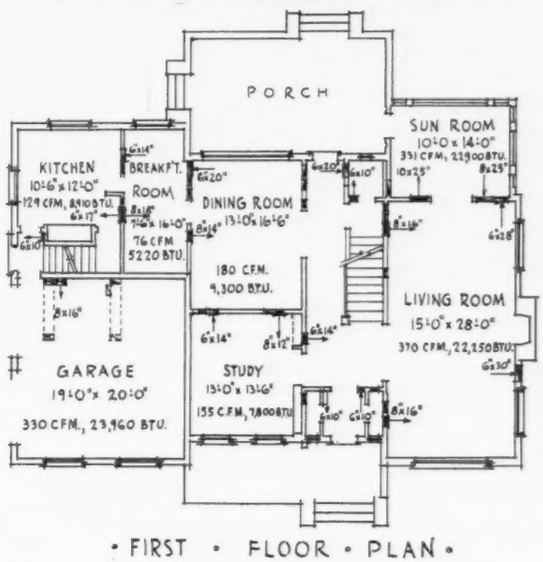


The photograph at the left shows the cooling coil (direct expansion) the blower below and return piping above. The switches and controls serve blower, heater, oil burner and compressor.



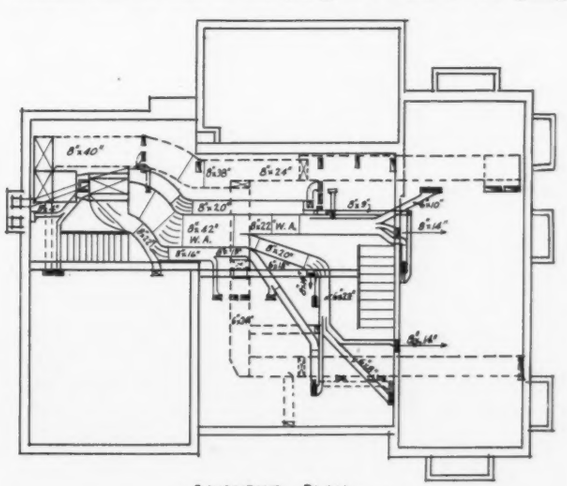
• SECOND • FLOOR • PLAN •

The second floor plan shows that every room has a supply register and a direct return. Note that each of the three bathrooms has a return which can be shut off in winter, but has been found valuable in summer cooling. For so large a house there are surprisingly few cross-overs.



• FIRST • FLOOR • PLAN •

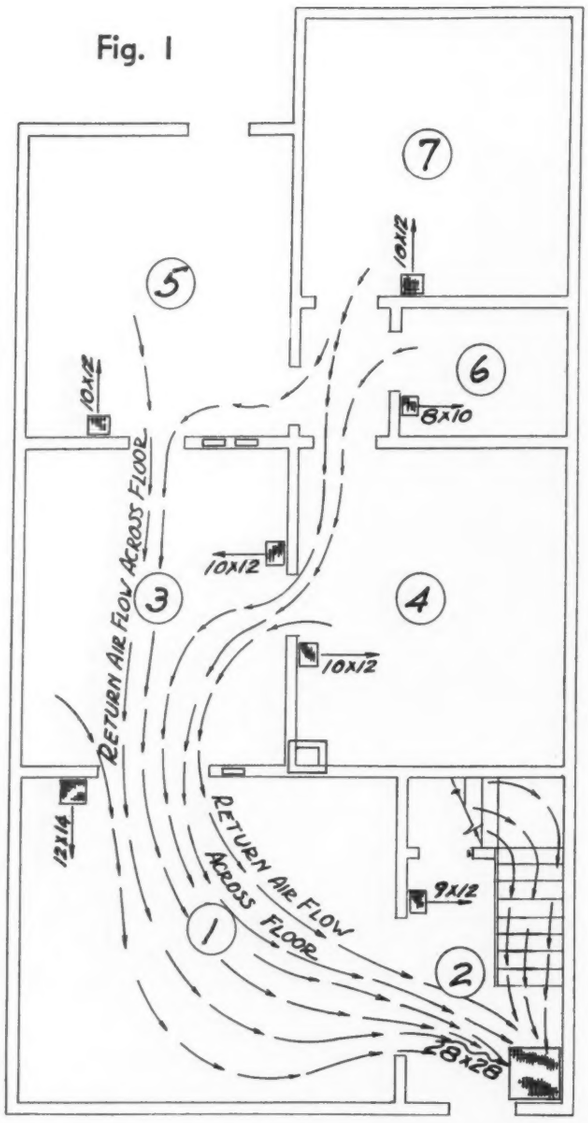
The first floor plan shows the garage with exposed, but heavily insulated, piping to second floor rooms, two supplies and two returns in the living room and supply and returns for all rooms excepting the kitchen and garage.



• BASEMENT • PLAN • •

The heater is placed in a far corner (part of the laundry) necessitating long runs of duct. Fortunately, partitions are so located that the duct work is compact for the size of the house.

Fig. 1



Converting Old Gravity Systems To Forced Warm Air

You can't pour more water into a jug that's already full—unless you first pour some water out.

Neither can you force more air into a room which is already full of air unless some of the room air can get out somehow—somewhere. Therefore, let's talk about circulation.

By G. A. Voorhees
Chief Engineer
Furblo Company

IN the early days of the furnace industry when furnaces were rightly called HOT air systems, the installers were usually trying to push hot air into rooms which were already completely filled with air without making any specific provision for getting room air (cold air) out.

In these older systems, the cold air supply for the furnace was drawn directly from out of doors though a fresh air duct, or indirectly by way of a cellar window. The air supply could flow up through the furnace and out to the various rooms only as fast as room air could escape from the building by leakage (exfiltration).

This outward leakage couldn't take place on the windward side of the house; wind pressure prevented it. Unless there were open fireplaces or other natural vents, the only escape of room air from the building was by seepage through cracks around windows and doors on the leeward side, which was necessarily slow.

Consequently the circulation through the furnace was equally slow. The air was in contact with the heating surfaces for a much longer time than in a modern gravity recirculating system and the air leaving the furnace was *decidedly HOT*.

It was hard to heat rooms on the windward side of the house. The coldest winds (and in many localities the prevailing winds in winter) come from the north and west and we still hear old time furnace men saying "heat naturally flows toward the south and east." That often was all too true of rooms in the house heated by the old hot air system which drew its cold air supply from out of doors.

More progressive furnace men learned to close up the "fresh air" intake and install a return air face (usually only one) at some convenient place in a first floor room. Heating results were better; air circulation was better; fuel costs were reduced. But there still was trouble in heating those rooms which were remote from the return air face.

The complaint was too often made that "such and such a room heats all right as long as I leave the door open, but as soon as somebody shuts the door, then that room won't heat." (We still hear that complaint).

In other words, just as long as the intervening doors between the hard-to-heat room and the return air face were left open so that room air could find its way freely back to the furnace through the return air duct—just for that long did the warm air flow freely into the room. But shut one of the doors and thus block the circulation, and the heat delivery fell off at once. Therefore, in houses of any size most of us used two or more return air faces to pick up cold air from different parts of the houses. This materially improved gravity circula-

tion by making it *easier* for cold air to get out of rooms and make way for warm air to flow in.

But, in gravity heating one drawback we've always had to contend with in increasing the number of return air ducts has been *frictional resistance,* which tends to retard circulation. Cold air seems to behave like cold molasses—it moves slowly and sluggishly. When we attempt to draw cold air by gravity flow from a remote room, we find that most of the return air flows through the short, direct returns from rooms near the furnace and practically none comes through the long, crooked ducts connecting to cold air faces in distant parts of the house.

It's true that if we make the short returns very small and the long returns quite large in cross section, it helps to balance the flow and overcome the difficulty, but whether they are large or small, long return air ducts seriously retard gravity circulation. Therefore, we try in gravity work, to group our return air faces within a reasonable and equal distance from the furnace and let it go at that.

Location of C. A. Faces

Since this arrangement has become common practice in gravity heating, most of the gravity warm air plants which are to be converted into modern, mechanical systems have from one to three return air faces; seldom more. *When we're called upon to change such a plant from gravity to forced circulation, one of our first thoughts should be to look over the house critically and see if the return air faces are so distributed that they can withdraw cold return air freely and effectively from all rooms.*

Since the new or remodeled system is to be of the forced air type we are no longer hampered by the "frictional resistance" which cuts the operating efficiency of a gravity plant having multiple returns. We have a blower exerting suction on the return air lines to overcome this friction.

Now that we are freed from the handicap of resistance which kept so many gravity systems from functioning properly, why not take advantage of it; why not locate return air faces *where they will do the most good* from the standpoint of satisfactory and comfortable heating. Then leave it to the blower to get the air back to the furnace.

We have all seen houses like that shown in Fig. 1 with one return air face located in the entrance hall near the front door, evidently with the idea that it would provide for recirculation from all first floor rooms; would take care of the cold air flowing down the stairway; and would meet the need which so many furnace men felt necessary of "having a cold air face near the front door." Those jobs heated by gravity—after a fashion. The most troublesome of the first floor rooms, of course, were usually numbers 6 and 7.

So far as breathing level air temperature in the rooms is concerned, the addition of a proper blower will be an improvement to most gravity plants with one out-of-the-way return air face like this.

With the increased air pressure on the hot side of the system (which the blower makes possible) dampers can be set so as to force warm air into the rear rooms. The pressure thus built up in Room 7 for instance, can be made strong enough to *force* air out of the room and eventually to the return air face in Room 2.

Even with all intervening doors wide open, it's a long drag for return air from Room 7 to find its way to the cold air face in the front hall. If this plant were being remodeled as a gravity system, most of us would install at least one additional return air face in or near one of the rear rooms, perhaps in the little passageway opening into Rooms 4, 5, 6 and 7. This would greatly improve gravity circulation so long as doors between the passageway and the adjoining rooms were left open. But suppose for instance, that the door leading into Room 7 is closed. There isn't enough opening (usually) under that door to permit free flow of cold air out of the room; circulation is retarded; the room doesn't heat properly.

What the Blower Does

Converted into a forced air system, we would have blower pressure forcing warm air into the room and the air pressure thus built up within the room would, in turn, force *more* return air out under the door than could escape under gravity flow conditions. But one of the advantages of forced air over gravity circulation is a lower register air temperature which in turn, means the *circulation of a greater volume of air to deliver a given quantity of heat.* The net result *may* be that when the door is closed, the room doesn't heat very much better than it did by gravity.

Room 7 might easily require the delivery of 160 cubic feet of air per minute for adequate heating. If the opening in the door casing is 30 inches wide and has as much as three quarters of an inch clearance between the bottom of the door and the floor, the free area of this opening is $30 \times \frac{3}{4} = 22.5$ square inches or 0.156 square feet. The velocity in feet per minute, of air flowing through any opening is equal to the air volume in cubic feet per minute, divided by the area of the opening in square feet. Hence, for 160 cubic feet of air per minute to get out of the room through a three-quarter inch opening at the bottom of a 30-inch door would require that it flow at a velocity of $160 \div 0.156 = 1026$ feet per minute which is altogether impractical. Even allowing for leakage around the sides and top of the door, the air flow is seriously restricted.

Check Furnace Size

Since we're centering our attentions in this article on return air, let's assume that we have already satisfied ourselves that the furnace is in good condition and is large enough to heat the house; and that all warm air leaders, while they may have been undersize in some instances for adequate gravity heating, have ample capacity (cross sectional area) to heat the rooms by forced circulation.

The surest and by all means the safest way to be sure of the furnace size, is to figure the heat losses of all rooms. This should be done whenever one is

(*Continued on page* 50)

Heat Loss Calculations For Space Heating* [Part 2]

By A. P. Kratz
Research Professor of Mechanical Engineering, University of Illinois

Method of Procedure

THE method of procedure for a wall for which the overall coefficient is unknown may therefore be summarized as follows: First, find the value of U by substituting the value of f, k, x, and c for the various surfaces and layers of solid materials in equation (6). A number of examples illustrating this method of calculation is given in Fig. 2. Second, use this value of U in equation (1) to find the total heat transmission for the wall under consideration.

This calculation should be made for each exposed wall, floor, ceiling, door and window for every room in the building. To the sum of these losses the infiltration loss as determined from equation (2) should be added. For any given room the heat loss so determined represents the heat that must be supplied by the radiators or warm air registers installed in the room.

It is not expected that it will be necessary to use the complete method of calculation outlined, for every building that comes under consideration for heating. A large number of values for U are available at present, and some of the short rules

*Address delivered at the Short Course in Coal Utilization, June 11, 12, 13, 1935, at Urbana, Ill.

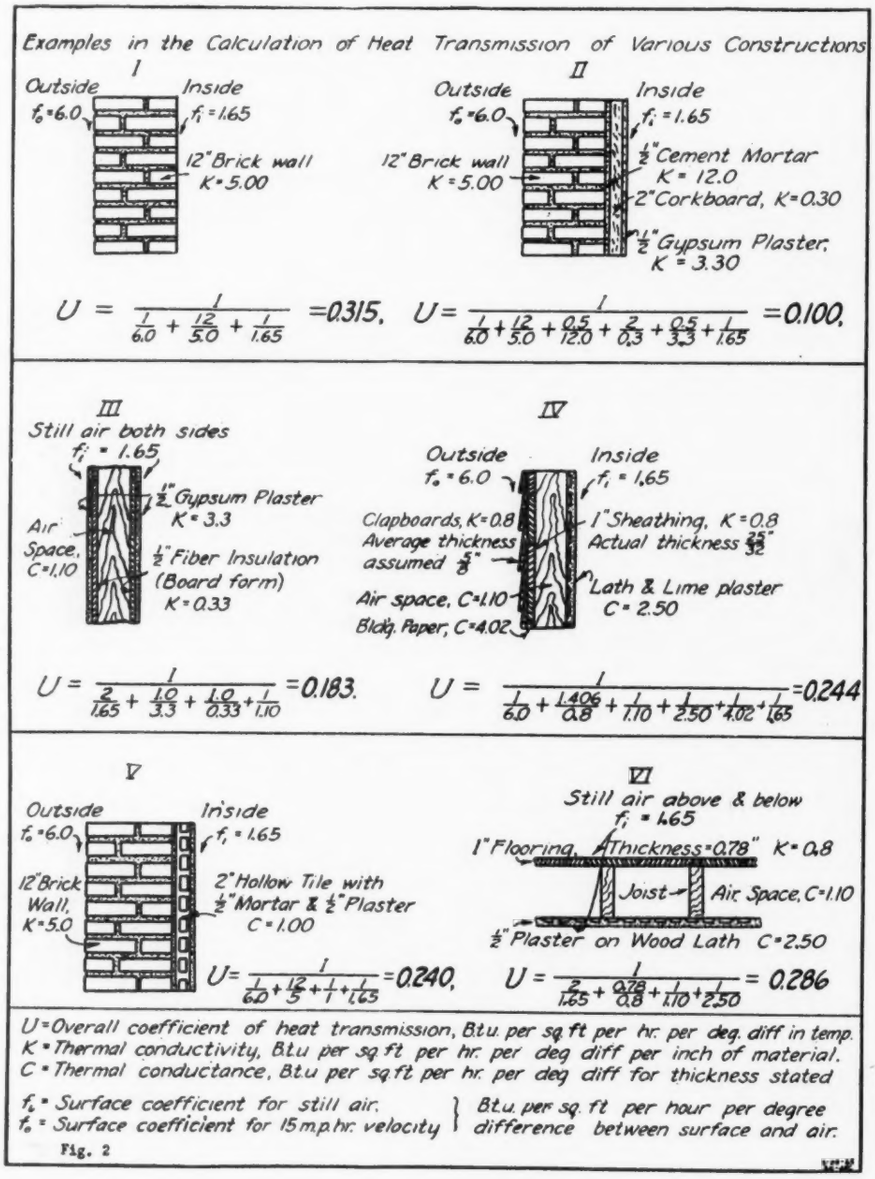

Examples in the Calculation of Heat Transmission of Various Constructions
I
Outside
f_o = 6.0
Inside
f_i = 1.65
12" Brick wall
K = 5.00
$U = \frac{1}{\frac{1}{6.0} + \frac{12}{5.0} + \frac{1}{1.65}} = 0.315.$
II
Outside
f_o = 6.0
Inside
f_i = 1.65
12" Brick wall
K = 5.00
½" Cement Mortar
K = 12.0
2" Corkboard, K = 0.30
½" Gypsum Plaster
K = 3.30
$U = \frac{1}{\frac{1}{6.0} + \frac{12}{5.0} + \frac{0.5}{12.0} + \frac{2}{0.3} + \frac{0.5}{3.3} + \frac{1}{1.65}} = 0.100.$
III
Still air both sides
f_i = 1.65
½" Gypsum Plaster
K = 3.3
Air Space, C = 1.10
½" Fiber Insulation (Board form)
K = 0.33
$U = \frac{1}{\frac{2}{1.65} + \frac{1.0}{3.3} + \frac{1.0}{0.33} + \frac{1}{1.10}} = 0.183.$
IV
Outside
f_o = 6.0
Inside
f_i = 1.65
Clapboards, K = 0.8
Average thickness assumed ⅜"
1" Sheathing, K = 0.8
Actual thickness 25/32"
Air space, C = 1.10
Bldg. Paper, C = 4.02
Lath & Lime plaster
C = 2.50
$U = \frac{1}{\frac{1}{6.0} + \frac{1.406}{0.8} + \frac{1}{1.10} + \frac{1}{2.50} + \frac{1}{4.02} + \frac{1}{1.65}} = 0.244$
V
Outside
f_o = 6.0
Inside
f_i = 1.65
12" Brick Wall, K = 5.0
2" Hollow Tile with ½" Mortar & ½" Plaster
C = 1.00
$U = \frac{1}{\frac{1}{6.0} + \frac{12}{5} + \frac{1}{1} + \frac{1}{1.65}} = 0.240.$
VI
Still air above & below
f_i = 1.65
1" Flooring, Thickness = 0.78" K = 0.8
Joist
Air Space, C = 1.10
½" Plaster on Wood Lath C = 2.50
$U = \frac{1}{\frac{2}{1.65} + \frac{0.78}{0.8} + \frac{1}{1.10} + \frac{1}{2.50}} = 0.286$
U = Overall coefficient of heat transmission, B.t.u. per sq. ft per hr. per deg. diff in temp.
K = Thermal conductivity, B.t.u per sq. ft per hr. per deg diff per inch of material.
C = Thermal conductance, B.t.u per sq. ft per hr. per deg diff for thickness stated
f_i = Surface coefficient for still air.
f_o = Surface coefficient for 15 m.p.hr. velocity
} B.t.u. per sq. ft per hour per degree difference between surface and air.

Fig. 2

give satisfactory results when tempered with judgment. But an understanding of the principles involved will certainly serve as an aid to the judgment in defining the limitations of the approximate rules, and will form the basis for arriving at a satisfactory solution for the cases in which the approximate methods fail, and for recognizing these cases before the failure has been demonstrated by the actual installation of the heating plant.

Besides serving as a basis for the design of the heating system, the heat losses from the building may be used to determine the size of grate necessary and to make an estimate of the probable fuel consumption for the heating season. The total heat loss from the house on the day having the maximum demand should be equal to the useful heat evolved on the grate with a reasonable combustion rate. A rate of 7.5 lb. of coal burned per square foot of grate surface per hour is usually regarded as reasonable for residence heating. The following formula may then be derived:

$$H = G \times C \times F \times 0.01\ E \qquad (7)$$

This may be expressed in the form

$$G = \frac{H}{C \times F \times 0.01\ E} \qquad (8)$$

in which G = area of grate in sq. ft., H = heat loss from building on maximum day in B.t.u. per hr., C = combustion rate in lb. of coal per sq. ft. of grate per hr., F = calorific value of coal in B.t.u. per lb., and E = efficiency of the heating plant in per cent.

Fuel Consumption

The fuel consumption for the season may be estimated from the heat loss for the maximum day by making use of either the mean outdoor temperature or the number of degree-days per season. The latter is defined as the difference in temperature between the daily mean and 65 deg. F. This is equivalent to stating that an outdoor temperature of 64 deg. F. maintained for 24 hours is equal to one degree-day.

If the heat loss for which the system is designed to meet the maximum demand, H, is based on the temperature difference indoor and outdoor of $(t - t_o)$, and the actual mean temperature difference is $(t - t_a)$, then the total heat loss for the season will be

$$\frac{H \times 24N \times (t - t_a)}{(t - t_o)}$$

The tons of fuel burned during a season will therefore be:

$$T = \frac{H \times 24N \times (t - t_a)}{F \times 2000 \times 0.01\ E \times (t - t_o)} \qquad (9)$$

in which T = tons of fuel burned per season, H = heat loss from building on maximum day in B.t.u. per hr., N = number of days in the heating season, F = calorific value of fuel in B.t.u. per lb., E = efficiency of heating plant in per cent, t = the indoor temperature in deg. F., t_o = the outdoor temperature on which the design was based in deg. F., and t_a = the actual mean outdoor temperature for the season in deg. F. In most localities the ratio $\frac{(t - t_a)}{(t - t_o)}$ is approximately ⅓, and for approximate calculations it is sufficiently accurate to use this value in equation (9).

Since one degree-day is equivalent to a temperature difference of one degree between the indoors and outdoors maintained for a period of 24 hours, the hourly heat loss, H, which is calculated for a building and based on a temperature difference $(t - t_o)$, is equivalent to a heat loss of $\frac{H \times 24}{t - t_o}$ B.t.u. per degree day. The tons of coal burned per season would therefore be:

$$T = \frac{H \times 24 \times N}{(t - t_o) \times F \times 2000 \times 0.01\ E} \qquad (10)$$

in which T = tons of fuel burned per season, H = heat loss from building on maximum day in B.t.u. per hr., N = number of degree-days per season, F = calorific value of fuel in B.t.u. per lb., E = efficiency of heating plant in per cent, t = indoor temperature in deg. F., and t_o = outdoor temperature on which the design of the plant was based in deg. F.

The values of N, the number of degree-days for different localities are available from the American Society of Heating and Ventilating Engineers' Guide and other handbooks. These two methods for estimating the seasonal fuel consumption should give the same result, and the choice between them is largely a matter of convenience or availability of data on seasonal temperatures or degree-days.

Examples

Example 1. A room 24 ft. long by 15 ft. wide has a 9-ft. ceiling and is exposed on the two ends and one side. The walls are frame construction (see IV in Fig. 2) and each exposure has two 3-ft. by 5-ft. double hung windows. Indoor temperature, 70 deg. F. Minimum outdoor temperature over ten-year period 25 degrees below zero. Find the heat loss.

Solution:

Window area = 6 × 3 × 5 = 90 sq. ft.
Lineal feet of crack (½ of total) = 3 (9 + 10) = 57 ft.
Gross wall area = 9 (24 + 15 + 15) = 486 sq. ft.
Net wall area = 486 — 90 = 396 sq. ft.
U for windows = 1.13
U for walls (see IV, Fig. 2) = 0.244

Wall loss	**= 396 × 0.244**	**(70 + 10)**	**=**	**7730 B.t.u. per hr.**
Glass loss	**= 90 × 1.13**	**(70 + 10)**	**=**	**8140 B.t.u. per hr.**
Infiltration	**= 57 × 0.71**	**(70 + 10)**	**=**	**3230 B.t.u. per hr.**
Total				**19100 B.t.u. per hr.**

Example 2. The heat loss from the Research Residence with an indoor temperature of 70 deg. F. and an outdoor temperature of 10 deg. F. below

(*Continued on page* 60)

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give satisfactory results when tempered with judgment. But an understanding of the principles involved will certainly serve as an aid to the judgment in defining the limitations of the approximate rules, and will form the basis for arriving at a satisfactory solution for the cases in which the approximate methods fail, and for recognizing these cases before the failure has been demonstrated by the actual installation of the heating plant.

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(*Continued on page* 60)

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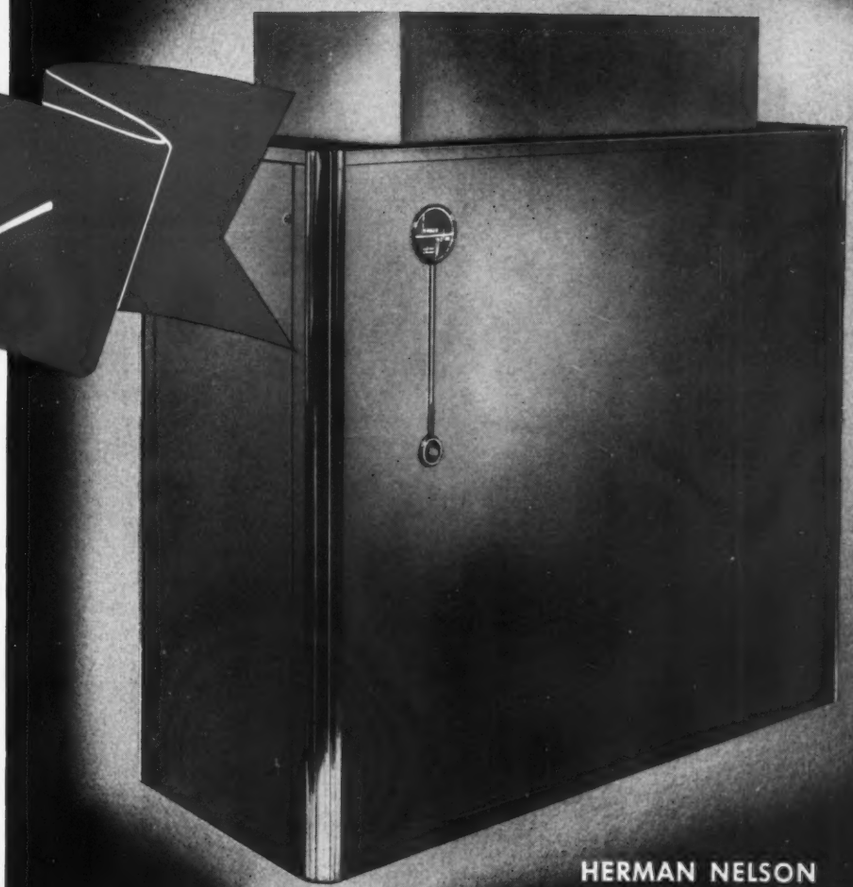

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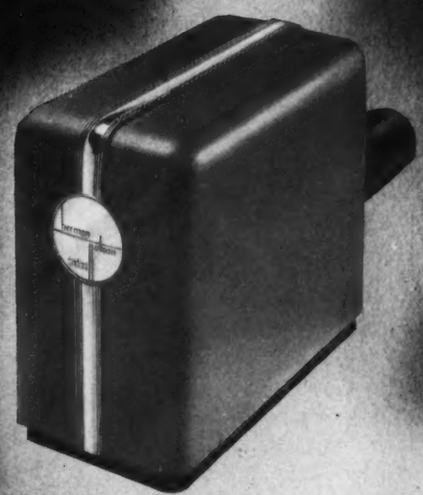

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Frost and Condensation on Windows [Part 2]

With relative humidities of a higher percentage being recommended by physicians and guaranteed by installers, frost and condensation has become an acute problem. This series of articles explains why condensation appears and suggests some methods for lessening and preventing its accumulation.

By L. W. Leonhard[1]
and J. A. Grant[1]

Formation of Condensation on Windows

THE factors that chiefly influence the deposition of moisture and the formation of frost are two in number.

1. The dew-point temperature of the inside air.
2. The temperature of the inside or room surface of the glass.

The dew-point temperature is determined solely by the moisture content, or more properly speaking, the steam content, of the air. The moisture content of the air is usually expressed in terms of the relative humidity in conjunction with the temperature of the air. Thus, if the temperature and the relative humidity are definitely known, the actual weight of water vapor, or steam, contained in 1 cu. ft. space, as well as the dew-point temperature, can be determined.

The control of the moisture content of the air offers the best possible means of controlling the dew-point temperature and, consequently, the deposition of frost and condensation. If the air is cooled, without the addition or subtraction of any moisture, the dew-point temperature remains the same as before. If the moisture content is increased, the dew-point temperature will be raised, practically regardless of what the room temperature may be, and, again, if the moisture content of the air be reduced, the dew-point temperature will likewise be lowered.

If it were always possible to keep the temperature of the inside glass surface above the dew-point temperature of the inside air, frost or condensation would never form upon the glass. The inside temperature of the glass is dependent upon a number of factors. It is evident that it will be influenced by both the inside and outside temperature of the air, and that it will have a value somewhere between these two. There will be a certain temperature gradient, or rate of temperature drop, accompanying the flow of heat from the warm air inside to the cold air outside. The character of the temperature drop will be determined by the nature of the resistances offered to the heat flow. The resistances to heat flow consist of a film of air in intimate contact with the glass on the warm side; the material of the glass itself; and a film of air in intimate contact with the glass on the outside. It is a very easy matter to control the inside air temperature, but increasing the air temperature does not affect a corresponding increase in the inside surface temperature of the glass, and for this reason, does not offer a practical method of eliminating the formation of frost and condensation.

Constructional Means of Preventing Condensation

The most effective means of increasing the inside glass temperature is to increase the resistance to the flow of heat through the glass itself, such as might result from the use of double glazing, double windows, or by applying some transparent insulating material in the path of the heat flow.

The prevention of frost and condensation by constructional means is more applicable where high humidities must necessarily prevail. It is to be noted, in this connection, that the benefit to be derived from even a few degrees increase of the inside glass temperature is very great, considering the fact that condensation and frost appear only on the coldest days of winter.

Double glazing, with an air space between, shows quite an advantage over single glazing as far as restraining the formation of frost and condensation is concerned, but there are also some important disadvantages which should be kept in mind:

1. The air contained between the two panes of glass must be practically dry air and a permanent air-tight seal around the edges between the two panes is necessary to keep moisture or moist air from penetrating into this confined space; otherwise condensation or frost will be found to accumulate upon the inside surface of the outside pane even for moderate temperature conditions which would not cause frost or condensation to form upon the inside surface of single glazed windows.
2. It is practically impossible, by ordinary glazing methods employing putty, etc., to make a permanent air-tight chamber between the two panes of glass. Temperature changes due to changing weather conditions cause an expansion or contraction of the air space between the panes of glass. This results in a breathing which draws moist air into the confined space and condensation takes place.

The same disadvantages hold true for double windows and storm windows. However, such installations seem more practical than double glazed windows because provisions can be made for cleaning the glass surface betwen the two windows and for ventilating the intervening air space.

1. *Research Engineer, Detroit Steel Products Co., Detroit, Michigan.*
2. *Professor of Mechanical Engineering, University of Michigan.*
3. *Chief Engineer, Detroit Steel Products Company, Detroit, Michigan.*

Candid camera catches Harold Mueller, president of L. J. Mueller Furnace Company, Milwaukee, Wisconsin, talking over the 1936 heating outlook with Mr. Hugo Tesch, prominent Milwaukee heating man.

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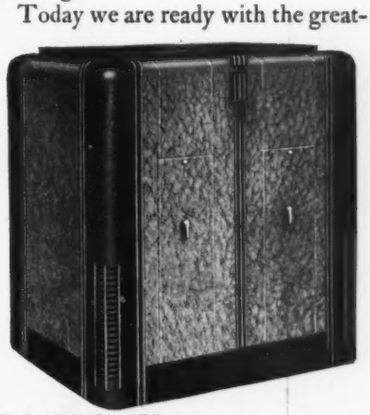

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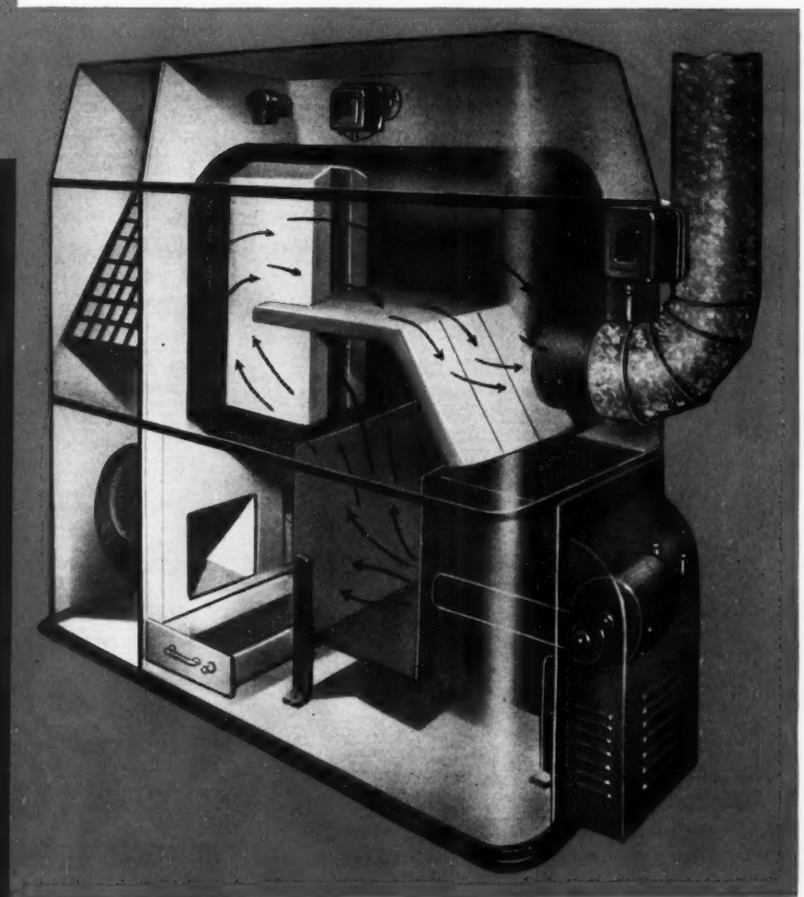

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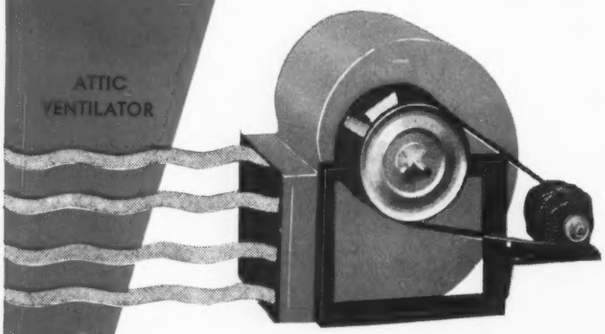

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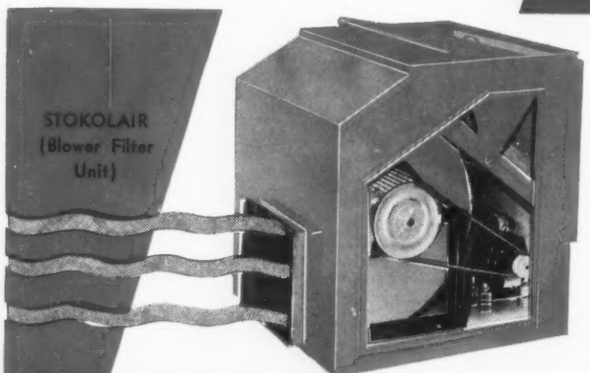
Schwitzer-Cummins Home Ventilator and Stokolair have everything home blowers should have. They are unusually rugged—heavy gauge steel all over—welded steel bottom—no loose attachments to rattle—balanced and silenced—rubber mounted and insulated throughout—no radio interference—low operating cost—attention only once a season—efficient and highly satisfactory.

You can't beat Stokolair's filter.

It is all metal—never needs replacing—high filtering efficiency—very low air restriction—cleaned but once a season—easily cleaned.



STOKOLAIR'S
FILTER LASTS A LIFETIME

Hy-duty blower wheels and silenced pillow blocks can be purchased separately.

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BLOWER DIVISION
FAN STREET—INDIANAPOLIS, U. S. A.

Oil Fired Installation

(*Continued from page 37*)

more than one register in a room. The sun room, for example, is glass on two sides and mirrors on the other two. The register is above the mirror with a return in the inside wall in the baseboard and by careful design of the piping this exposed room has been satisfactorily heated in all kinds of weather.

Quite a bit of ingenuity was required to get the duct work inside allotted spaces; also the differences in floor and ceiling levels on all three floors meant up and down runs and twists. Further to complicate the problem, the heater room is one corner of the laundry and had to be compact in order

The exterior is stone and stucco with less-than-usual glass area per square foot of wall.

to get the furnace, oil burner, blower, coils, compressor in the limited area.

For summer cooling a 5-ton compressor with the coil mounted above the blower and the compressor under the basement stair solved space limitations. The same thermostats used for winter heating control the cooling cycle. Summer temperatures of 70 degrees are possible. In place of complete recirculation as used in winter, outside air up to 100 per cent can be used in summer by adjusting the outside air damper.

The owner of the house was insistent on two results. First he wanted an economical cost of operation and second he wanted the minimum of temperature difference betwen floor and ceiling and from room to room. Numerous thermometers were placed in the different rooms—some hung near the ceiling, others near the floor, others at the breathing level. Tests and readings showed floor-ceiling differences of not more than 5 degrees in cold weather and practically no difference in room temperature.

Extreme care was taken by the designers to size ducts so that the calculated amount of air would be delivered to each room. Balancing dampers were installed in each branch as a precautionary measure because all ducts are plastered in and once completed alterations were out of the question. Very little setting of dampers was required.

That the owner's specification for economy of operation was met is indicated by the fact that the oil cost for 1934-1935 was $150.00 and for 1935-1936 $140 plus approximately $2 per month for electricity.

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This Trade Mark
NU-WAY GENII
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Automatic OIL BURNERS

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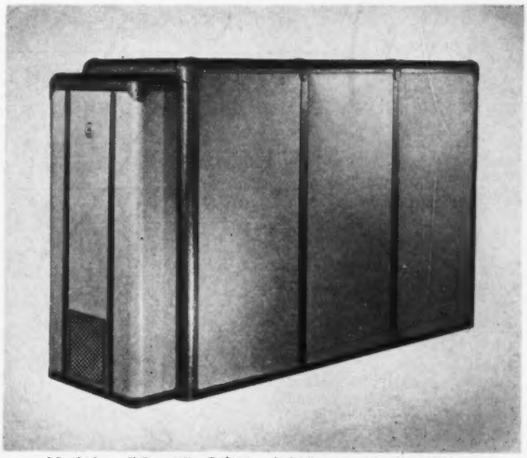
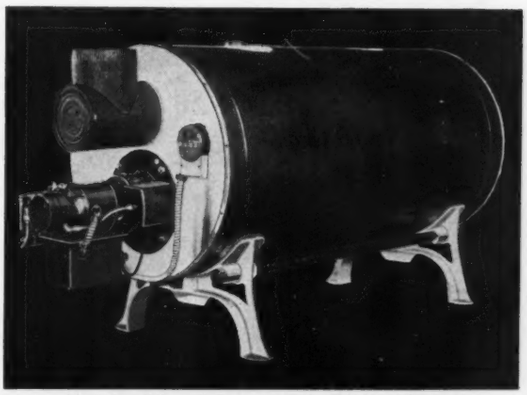
The Nu-Way Corporation will display the finest and most complete line of automatic oil burning heating equipment ever offered to dealers of this country — ALL UNDER FIRE — at the Detroit Show—April 14-18, 1936.



Nu-Way "Genii" Oil-Fired Winter Air-Conditioner



Nu-Way "Genii" Domestic Hot Water Heater

THE COMPLETE LINE

FIRST	Nu-Way "Genii" Quality Automatic Oil Burners (In Four Sizes).
SECOND	Nu-Way "Genii" Evans Automatic Oil-Fired Winter Air Conditioner.
THIRD	Nu-Way "Genii" Automatic Oil-Burning Boiler Unit.
FOURTH	Nu-Way "Genii" Automatic Oil-Burning Domestic Hot Water Heater.

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These products all carry the reputation and the endorsement of the name, "Nu-Way 'Genii'"—a name of a pioneer in the field of oil burning and a name that reflects quality, dependability and successful operation to the consumer.

The Year of 1936 will be an outstanding year in sales of automatic heating. Every good dealer to succeed must have a good product and a complete line of recognized units.

The Nu-Way Corporation in 1936 is offering a franchise of value to well-established dealers. This franchise carries with it the assurance of quality-tested products backed by comprehensive advertising. The market is now right for the right dealer with the right line.

See us at the Detroit Show, or write for full information about these outstanding products.

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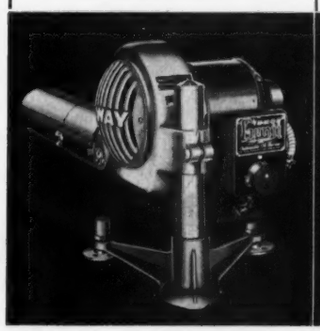
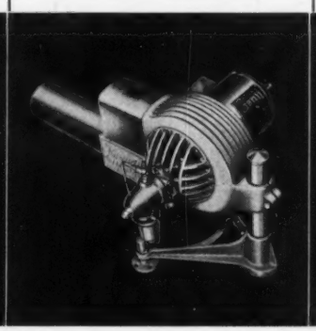
Model MV-S	Model LD-25	Model HP-55	Model MS-35
			

Converting Gravity Systems

(*Continued from page 39*)

in doubt; it should ALWAYS be done by one whose warm air heating experience is limited. But for our present problem, we'll assume that we've had enough heating experience to be able to say as soon as we have looked over the house and compared our mental estimate of the heat requirements with our knowledge of the heating capacity of the type and size of furnace being used, "the furnace is amply large for the house."

While it's often safe to determine by inspection that the furnace and the warm air ducts are large enough without figuring details, it's not at all easy to estimate accurately just how many cubic feet of warm air per minute should be delivered to a given room at a given register air temperature in order to heat that room.

If we don't now how many c.f.m. the revamped plant is to deliver to each room, how are we to know how large the return air duct from each room or group of rooms, should be.

Some Simple Rules

Here are several simple, easily applied rules which work out well (1) If used with judgment and common sense, (2) If the furnace is large enough and (3) If the warm air supply ducts are large enough:

Rule 1. The blower should be of sufficient capacity to recirculate the air five times per hour. The c.f.m. required, is equal to the cubic content of the house in cubic feet, multiplied by 0.08.

Return Air duct areas in square inches for rooms having various exposures are as follows:

Rule 2. For room with one side exposed and average amount of glass surface, multiply cubic content by 0.024.

Rule 3. For room with one side exposed and with unusually large glass exposure (such as large projecting bay window, etc.) multiply cubic content by 0.03.

Rule 4. For room with two sides exposed and average amount of glass surface, multiply cubic content by 0.036.

Rule 5. For room with two sides exposed and large glass surface, multiply cubic content by 0.042.

Rule 6. For room with three sides exposed and average glass surface, multiply cubic content by 0.048.

Rule 7. For room with three sides exposed and moderately large glass area, multiply cubic content by 0.054.

Rule 8. For sun rooms and inclosed porches which are heated in winter, multiply cubic content by 0.06.

Rule 9. The free area of the return air face should be one-third greater than the area of the duct as determined by the above rules.

For the benefit of those readers who hesitate to use a rule without understanding how it is derived, the following explanation is given:

It is assumed that for the "average" house, a gravity warm air plant recirculates the air about three times per hour and experience has shown that when a plant is converted from gravity flow to mechanical circulation, an increase of about 65% or 70% in the volume of air circulated, gives good results. If the blower installed is of a size and capacity to provide five recirculations per hour, this is an increase of 66⅔% over the assumed gravity rate of three recirculations per hour; hence five recirculations per hour for the house as a whole, may be considered adequate.

C. F. M. Formula

The volume of air expressed in cubic feet per minute, which must be circulated to provide a given number of air changes or recirculations per hour is expressed by the formula:

$$\text{C.F.M.} = \frac{\text{(Cubic Cont. in Cu. Ft.)} \times \text{(No. of air changes per hour)}}{\text{60 minutes per hour}} \quad \ldots(1)$$

For five recirculations or air changes per hour, this formula becomes:

$$\text{C.F.M.} = \frac{\text{(Cubic Content in Cu. Ft.)} \times 5}{60}$$

$$= \text{(Cubic Content, Cu. Ft.)} \times 0.08$$

which gives the foregoing Rule 1.

The area of a duct in square inches, required to carry a given volume of air (CFM) at a given velocity in feet per minute (F.P.M.) is expressed by the formula:

$$\text{(Area in Sq. Ins.)} = 144 \times \frac{\text{CFM}}{\text{FPM}} \quad \ldots\ldots\ldots\ldots(2)$$

Substituting in equation (2), the value of CFM expressed by the second member of equation (1), we get:

$$\text{(Area, Sq. Ins.)} = \frac{2.4 \times \text{(Cubic Cont.)} \times \text{(No. air changes per hour)}}{\text{FPM}} \quad \ldots(3)$$

Assuming a velocity of 400 F.P.M. as being conservative for the average return air duct in a remodeled residence system, formula (3) becomes:

(Area Sq. Ins.) = 0.006 × (No. changes per hour) × (Cubic Cont.) .....(4)

For a room with one side exposed and no more than an average area of glass surface, four air changes or recirculations per hour are usually ample, and substituting this value in equation (4), we get:

$$\text{(Area Sq. Ins.)} = 0.006 \times 4 \times \text{(Cubic Cont.)}$$

$$= 0.024 \times \text{(Cubic Cont.)}$$

Thus we get the factor 0.024 given in Rule 2.

If such a room, with one side exposed, has an unusually large glass exposure, it needs a greater volume of warm air to maintain its temperature and consequently a greater volume of cold return air must be removed. For such a room, five air changes or recirculations per hour is a fair average and the return air duct area as given by equation (4), will be:

$$0.006 \times 5 \times \text{(Cubic Cont.)}$$

$$= 0.03 \times \text{(Cubic Cont.)}$$

which is expressed in Rule 3.

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Control Systems

BROWN INSTRUMENTS FOR INDICATING RECORDING AND CONTROLLING

The remaining rules 4 to 8 inclusive are derived in a similar manner allowing 6 air changes for a room with two sides exposed and average glass area, 7 air changes for two exposed walls and large glass exposure, 8 changes for three walls and normal glass, 9 changes for three walls and rather large glass and 10 changes for a sun room with three sides exposed and the exceptionally large glass areas which such rooms have.

Rule 9 is based on an assumed air velocity through the free area of the return air grille, of 300 f. p. m.

It must be borne in mind that return air ducts sized by these rules are approximations only. A room for which five air changes per hour are assumed, *may* require six. Therefore every air duct, both warm air supply and cold air return, should be equipped with a well fitted damper having a lock-quadrant or lock-dial so that it may be adjusted to suit the needs of the room and securely locked in position.

Profit Should Be Considered

Since the purpose of all engineering as applied to warm air heating, is to help increase profits, we must always recognize the difference between the precise and time-consuming methods which are very necessary in designing elaborate and unusual systems, and the distinctly practical and well-warranted, approximate methods which are rightly applied to the simpler types of conversion jobs.

The heating contractor who is alert to the profit making possibilities of converting old and often inadequate gravity plants into more efficient and satisfactory forced air systems, will find a surprisingly large number of dwellings where the furnaces are not undersize, yet heating results are unsatisfactory because of poor air circulation. The owner of such a house wants, and usually *can get*, more heat if the blower is made part of the existing plant. He wants better *distribution* of heat which forced circulation also makes possible. At the same time, he wants to keep the cost within reason; hence, he's not expecting an IDEAL system. What he does want and expect, is as much *improvement* in heating results as is consistent with a moderate investment.

For the many such cases the time-saving methods suggested in this article enable the heating contractor to convert the plant from gravity to mechanical circulation at a minimum of cost—and under the circumstances this saving in cost helps to land the sale.

To summarize: When the furnace is of ample size and is connected to a chimney which provides sufficient draft; and when warm air leaders are *nearly* large enough for good gravity heating; the addition of a blower of proper capacity plus (usually) some rearrangement of the return air system, can be carried out successfully by merely applying the foregoing rules with reasonable judgment.

The next installment of this series will discuss the location of return air faces and ducts in the small house which we have been considering to see how unnecessary installation costs can be avoided.

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• With the advent of air conditioning your customers acquired new ideas about what they want in heating systems. They demand complete air conditioning and increased efficiency. Makeshift adaptations of old principles will not do. This is why Dailaire heating and air conditioning units are designed to do a job in keeping with the times.

This smart new Dailaire casing encloses oil or gas burner, blowers, washers and filters

A unique advantage of Dailaire design is the Armco Stainless Steel wedge-shaped dome, having a high heat transfer coefficient and withstanding 600° higher temperature. Its divided downdraft flue construction provides large and efficient radiating surface. A blower system above the unit delivers 23% more air.

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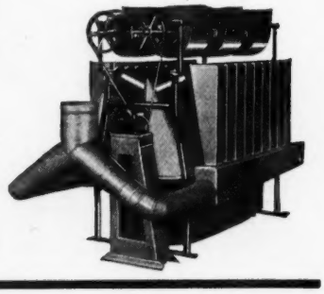
Dailaire unit for large homes, public buildings and factories.



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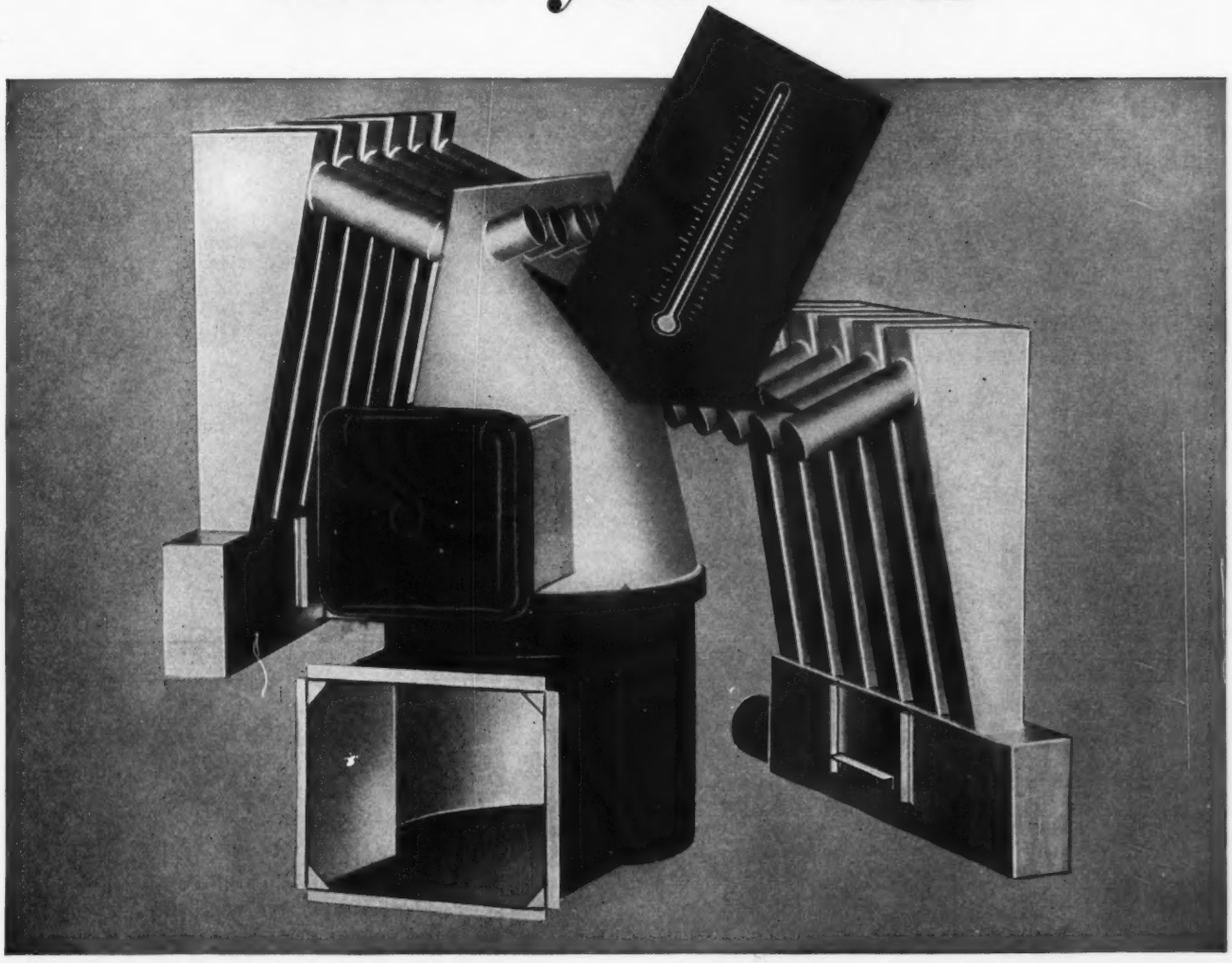

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CALL THE ARMCO DISTRIBUTOR

ARMCO

ARMCO STAINLESS STEELS

Controls for Gas Burners

(*Continued from page 35*)

etteville. The length and severity of a normal season are different in other localities, but the average load factor is always quite low, so that a comparison of economy figures in Fayetteville will be fairly representative of the whole country.

For a heating plant rated at 500 sq. ft. of steam radiation, 21.6 per cent of rating would be 108 sq. ft. The gas consumption in cubic feet per hour, corresponding to an output of 108 sq. ft., was then picked off each consumption curve and multiplied by 5260 (the approximate number of hours in a heating season in Fayetteville), to get the seasonal consumption. The result will be accurate for methods Nos. 1 and 4, but not quite accurate for methods Nos. 2 and 3, due to curvature of the consumption-load line in the latter case. The error, however, is quite small. The following table gives the hourly and seasonal consumption figures for all burners and control methods tested, together with percentages of increase in consumption caused by the use of inefficient controls.

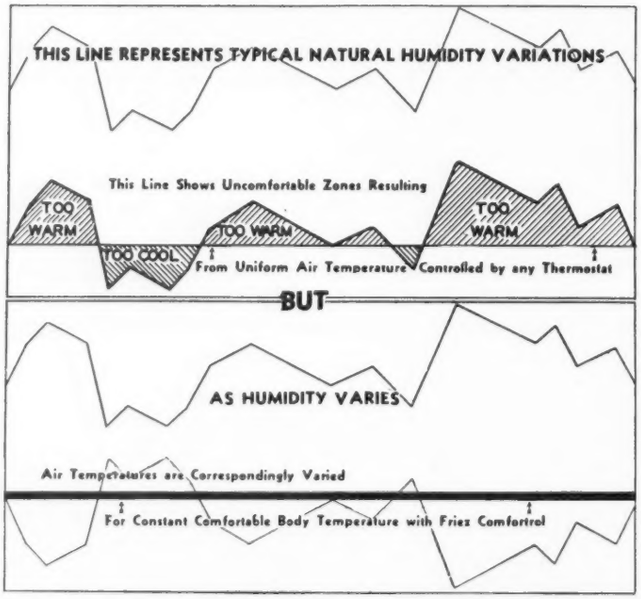
Data and results of individual tests are quite voluminous and, for that reason, are not included in this report. They are, however, being kept on file for reference.

The results are summarized in the following table:

Estimated Seasonal Gas Consumption of a Steam-Heated House in Fayetteville, Arkansas, With Conversion Gas Burners and Various Control Methods.
Boiler Rating With Coal, 500 Sq. Ft. of Steam Radiation
Gas Heating Value, 983 B.t.u. Per Cubic Foot.
Length of Heating Season, 5260 Hours.

Burner Number	Control Method Number	Cubic Feet of Gas per Hour at 21.6% of Rating	Total Gas Consumption for Season	Percentage Based on Most Economical Control Method	Percentage Excess of Nos. 2 & 3 Over Nos. 1, 4, and 5	Percentage Excess of No. 6 Over Nos. 1, 4, and 5
1	1	41.40	217,600	100.0		
	2	46.20	242,800	111.8	11.8	
	3	46.20	242,800	111.8	11.8	
	4	41.40	217,600	100.0		
	5	41.40	217,600	100.0		
	6	42.20	22,200	102.0		2.0
2	1	43.95	231,000	100.0		
	2	46.00	241,800	104.5	4.5	
	3	46.00	241,800	104.5	4.5	
	4	43.95	231,000	100.0		
3	1	44.95	236,300	100.0		
	2	49.70	261,200	110.5	10.5	
	3	49.70	261,200	110.5	10.5	
	4	44.95	236,300	100.0		
4	1	46.28	243,200	100.0		
	2	50.40	264,900	109.0	9.0	
	3	50.40	264,900	109.0	9.0	
	4	46.28	243,200	100.0		
				Averages	9.0	2.0

THERMOSTAT or COMFORTROL ?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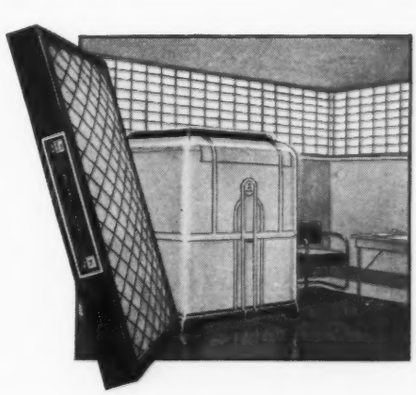


Konzo Duct Resistance

(*Continued from page* 34)

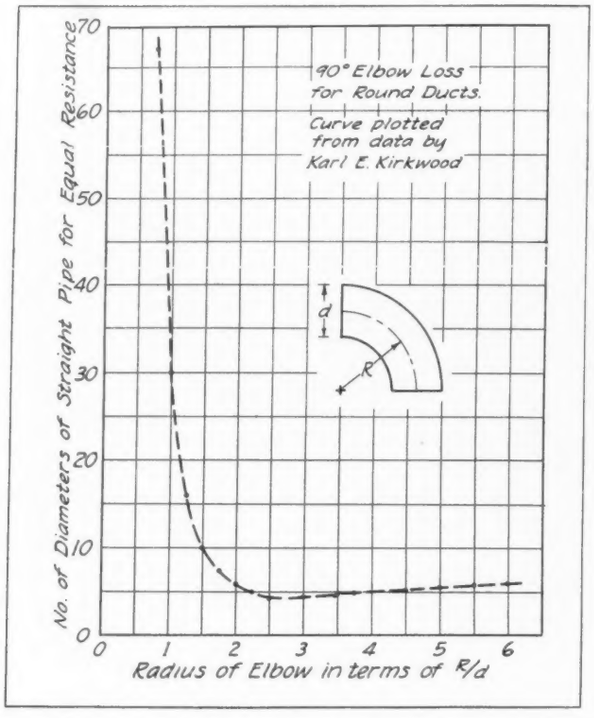


Fig. 5—Frictional resistance of a 90 degree elbow from data by Karl E. Kirkwood. (Replotted by S. Konzo.) See also Table 2A.

pressed in two forms; in the former paper as "Per cent of Velocity Head Lost in the Bend," and in the latter two papers as "Equivalent length of straight pipe expressed in diameters." For purposes of comparison, the writer has converted the values listed in Tables 2a and 3 to terms of "equivalent length of pipe." Note the numerical values enclosed in brackets, which are approximate values derived from a method suggested in the original paper. A loss of "10 pipe diameters" means that the frictional loss of a 6 in. elbow is equivalent to the loss in 6 x 10 in. or 5 ft. of straight pipe. If the elbow were 18 in. in diameter, the loss under the same conditions would be equivalent to the loss of 18 x 10 or 15 ft. of straight pipe.

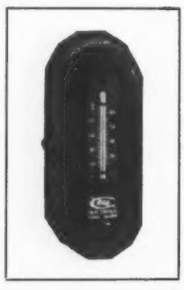
The following discussion on the frictional resistance of 90 degree elbows applies to the results as presented in Tables 2, 3 and Figs. 4, 5.

1. The values listed in Tables 2a, 2b, and 2c for round elbows are not in very close agreement, particularly for elbows having a radius, "R," less than the diameter of the pipe.

2. In one respect, however, the results obtained by all three experimenters are in excellent agreement. It may be noted that when the elbow has a radius, "R", less than approximately 1.5 times the pipe diameter the frictional loss is excessive. This is illustrated graphically in Fig. 5.

This fact is of great importance to all sheet metal installers and manufacturers of sheet metal fittings. In fact good practice demands *"that the inner radius of*

COOK CONTROLS



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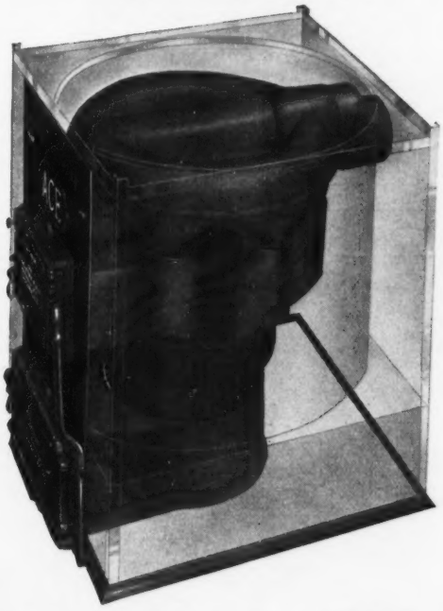

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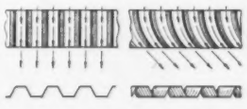

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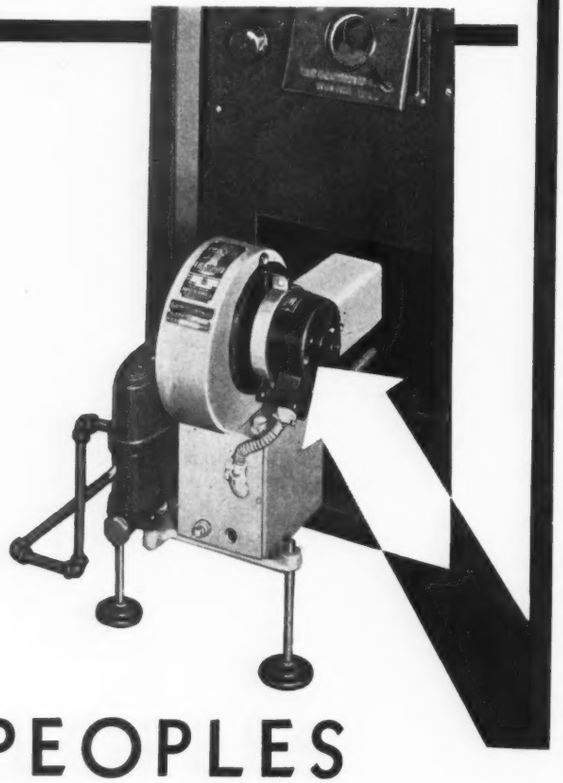

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an elbow shall not be less than the diameter of a round pipe nor less than the width on the turn of a rectangular pipe." If sharp turns are necessary, ample allowance should be made in the calculations for frictional resistance of the elbow.

3. Not much is to be gained by making the radius, "R", as indicated in Figs. 4a and 4b, greater than twice the diameter or width. In fact, the results of Kirkwood gives an increase in resistance for ducts having larger turning radius than 2.5 D.

4. The values selected from Tables 2a, 2b, and 2c for pressure loss in round elbows, having a radius equal to 1.5 D, are respectively 8.5, 10, and 10 diameters. Therefore, *"For ordinary calculations one easy long-radius elbow* in a *circular pipe may be considered* as *equal in friction loss to 10 diameters of straight pipe."*

5. The values listed in Table 3 for rectangular ducts indicate that the frictional resistance is approximately half that for circular ducts having the same radius of curvature. Although the use of "5 pipe diameters" is permissible for rectangular ducts having one easy, long-radius elbow, most designers make no distinction between round and rectangular pipes and use "10 pipe diameters" for all their calculations. The choice between the two values is entirely up to the discretion of the installer.

6. Similarly, the choice of any one set of data among the three sets listed in Table 2 is left to the discretion of the installer. The writer prefers the data listed in Table 2b, if for no other reason than the fact that the values for small radii seem to be midway between similar values listed in Tables 2a and 2c.

TABLE 2

Pressure Loss in Round Elbows

See Fig. 4a for dimensions

Ratio $\frac{R}{d}$	0.	0.5	0.75	1.00	1.25	1.50	1.75	2.0	3.0
Table 2a—Data from paper by Frank L. Busey									
Loss in per cent velocity head	.87%	75%	38%	26%	20%	17%	16%	14%	14%
Approx. equiv.* length, straight pipe	(44d)	(38d)	(19)	(13)	(10)	(8.5)	(8)	(7)	(7)
Table 2b—Data from paper by Wm. D. Edwards									
Equiv. length over straight pipe	.200d	121d	35	17	13	10	9	9	8
Table 2c—Data† from article by Karl E. Kirkwood and Amer. Blower Corp.									
Equiv. length straight pipe	67d	30	16	10	7.5	6	4.5		

*Approximate value of equivalent length based on considering "one velocity head" lost in 50 diameters of straight pipe.

†Values in original table revised in order to make ratio of R to d agree with the convention used in Tables 2a and 2b and Fig. 4a. See also Fig. 5 showing plotted data.

7. In certain cases structural difficulties make it necessary to use very small radius turns for elbows. No particular difficulty is encountered if sufficient allowance is made for the frictional resistance of the elbow. From the data furnished in Table 2 it may be noted that a sharp-cornered elbow many introduce as much resistance as 100 pipe diameters. This would be

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equivalent, in the case of a 6 in. diameter pipe, to 50 ft. of straight duct. In the case of an 18 in. diameter duct, one sharp elbow may introduce as much resistance as 150 feet of straight duct. Such frictional resistances cannot be ignored without encountering difficulties in balancing the plant and in obtaining satisfactory air flow. Where conditions necessitate sharp bends the use of turning blades is recommended. The succeeding article will cover this phase of the subject in greater detail.

TABLE 3

Pressure Loss in Square Elbows

(From paper by Frank L. Busey)

(Compare with values listed in Table 2a by same author)

Ratio $\frac{R}{W}$ (See Fig. 4b)	0	0.5	0.75	1.00	1.25	1.50	1.75	2.0	3.0
Loss in per cent velocity head	125%	95%	33%	18%	12%	8%	8%	7%	7%
Approximate* equivalent lengths	(63)	(48)	(17)	(9)	(6)	(4)	(4)	(3.5)	(3.5)

*Approximate value of equivalent length based on considering "one velocity head" lost in 50 diameters of straight pipe. See original paper.

Heat Loss Calculations

(*Continued from page* 41)

zero, (— 10), is 136,000 B.t.u. per hr. Assuming a combustion rate of 7.5 lb. of coal burned per sq. ft. of grate per hr. and a plant efficiency of 60 per cent with coal having a calorific value of 12500 B.t.u. per lb., calculate the size of grate required.

Solution: From equation (8)

$$G = \frac{136000}{7.5 \times 12500 \times 0.60} = 2.42 \text{ sq. ft.}$$

This is equivalent to a grate 22 ins. in diameter. The grate actually installed was 23 ins. in diameter, and experience proved this to be ample.

Example 3. The mean outdoor temperature at Urbana, Illinois, is approximately 40 deg. F. and the length of the heating season is 210 days. Calculate the tons of coal having a calorific value of 125000 B.t.u. per lb. required to heat the Research Residence cited in Example 2.

Solution:

$$\text{The actual ratio } \frac{70 - 40}{70 + 10} = \frac{30}{80} = \frac{1}{2.7}$$

Using this value in equation (9).

$$T = \frac{136000 \times 24 \times 210}{12500 \times 2000 \times 0.60 \times 2.7} = 16.9 \text{ Tons}$$

With good firing methods and high overall plant efficiency the actual fuel consumption for one season was approximately 14.5 tons.

Example 4. The heating season for Urbana, Illinois, consists of approximately 6160 degree-days. Assume coal with a calorific value of 12,500 B.t.u. per lb. and calculate the tons of coal required to heat the Research Residence cited in Example 2.

Solution: From equation (10),

$$T = \frac{136000 \times 24 \times 6160}{(70 + 10) \times 12500 \times 2000 \times 0.60} = 16.8 \text{ Tons}$$

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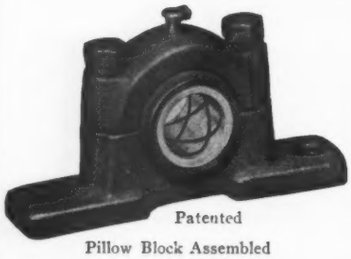

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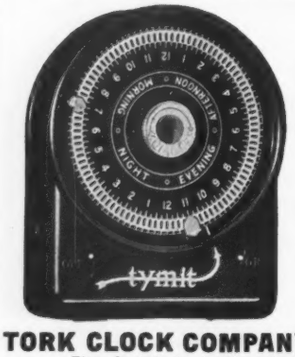

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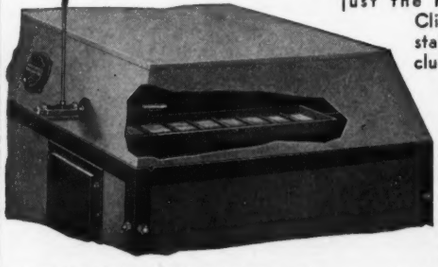

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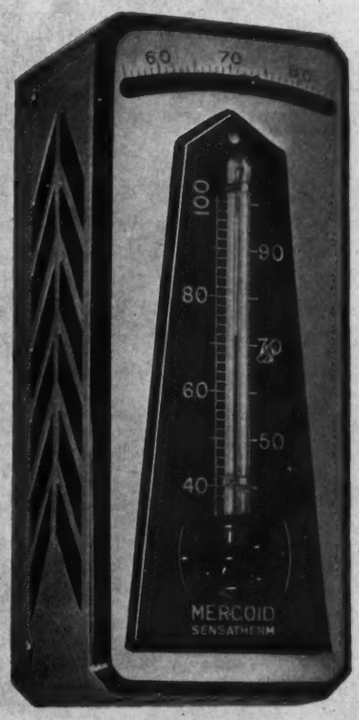

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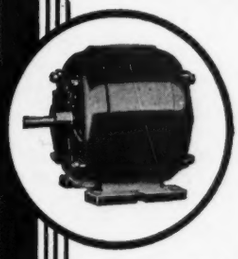

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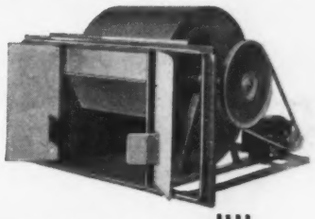

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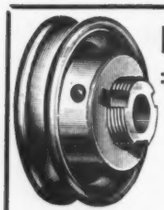

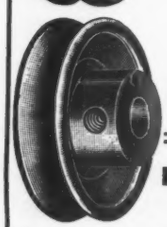

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Oil Burning Controls

(*Continued from page* 31)

there was a time when the burner was controlled by the steam pressure limiting device which allowed the steam pressure to vary between ½ lb. per sq. in. and 4 lb. per sq. in The colder the weather the longer the period of such pressure controlled operation and during all of this period the damper remained open continuously. Since the starts and stops are quite frequent and the brick work would be at a red heat, the loss in off periods during these warming up times would be appreciable. Therefore the figure of 7.2 per cent saving for the damper during the dual operation period is considered to be somewhat low.

Fig. 6 shows a chart of flue gas and boiler water temperatures for a typical day with damper operation and

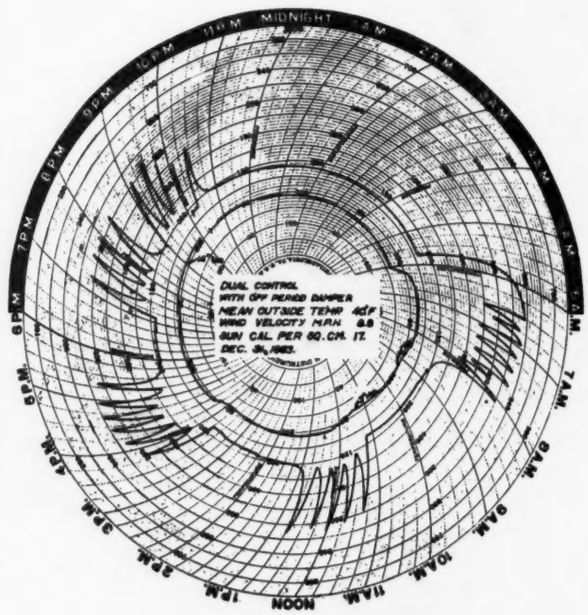

Fig. 6—Typical daily chart showing flue gas and boiler water temperatures with off-period damper in use

Fig. 7 is a similar chart for operation without the damper. The boiler water dropped in temperature to about 160 F. during the night period of lower room temperatures when the off-period damper was in use as shown on Fig. 6. Without the use of the damper the water temperature dropped to about 140 F. These values were checked by mercury thermometers. The heat loss involved in this 20 degree difference is not appreciable and cannot account for the saving secured with the damper. The charts show a period of 15 minutes to bring the water to boiling during the warming up period on days when the damper is used and about 5 minutes longer on days when it is not used. The efficiency during this period would be low due to cool brick work and to the necessity of bringing it up to temperature. The water temperature record pen led the flue gas temperature pen on this recording instrument by 15 minutes, to allow for the passing of the pens.

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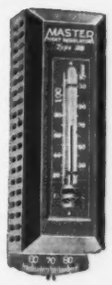

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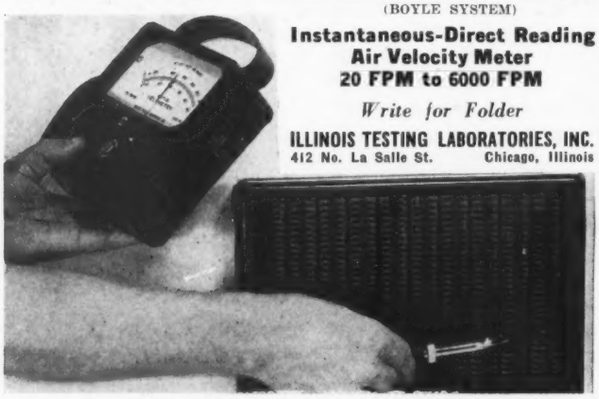

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cury thermometer at the upper range, but are known to be too high at the lower range. It is believed that the flue gas temperature approaches very closely the water temperature during the long off period at night. When the off-period damper is used, air circulation past the thermometer bulb is stopped which affects the reading. The cooling of the boiler water after periods of operation under control of the thermostat is due not only to boiler losses, but also to the generation of steam

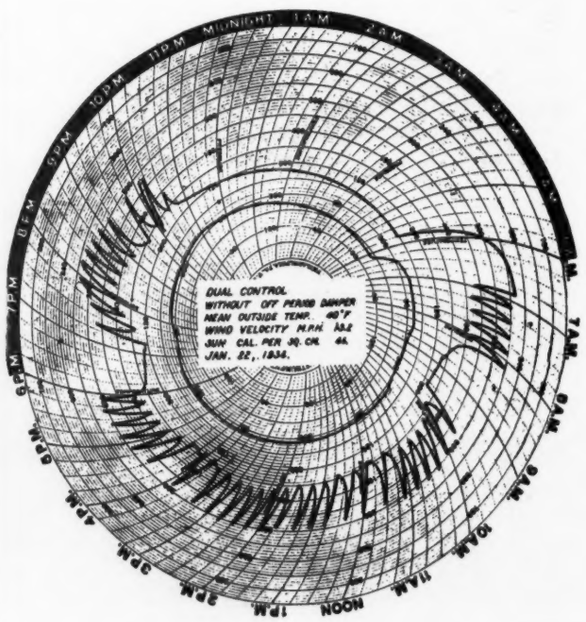

Fig. 7—Typical daily chart showing flue gas and boiler water temperatures without the use of the off-period damper

at sub-atmospheric pressures. As shown on Fig. 6 a vacuum of 10 in. mercury existed at 9 a.m. after the period of pressure controlled operation and 2 hours later when the thermostat called for additional heat, there still was a 3 in. vacuum. Since all of the material in the house has not been brought up to temperature in the warming up period of pressure control, the vacuum secured directly after this period is greater than after periods under control of the thermostat. The periods of operation under control of the thermostat, which has a built-in heating coil were found to be all of about the same length and averaged about 6 minutes. During this 6 minute period, the flue gas temperature rises. During the long initial running period early in the morning, the flue gas temperature approaches a stable value such as would be obtained on continuous operation. Fig. 6 shows 26 starts on that day and Fig. 7 shows 43 per day. The greater number in the latter case seems to be due to the greater wind velocity. On continuously maintained temperature operation, the number of starts would be greater. After each period of operation an off-period follows in which losses occur, part of which may be prevented by shutting off air circulation through the boiler at such times.

[Part 2 covering field tests to follow]

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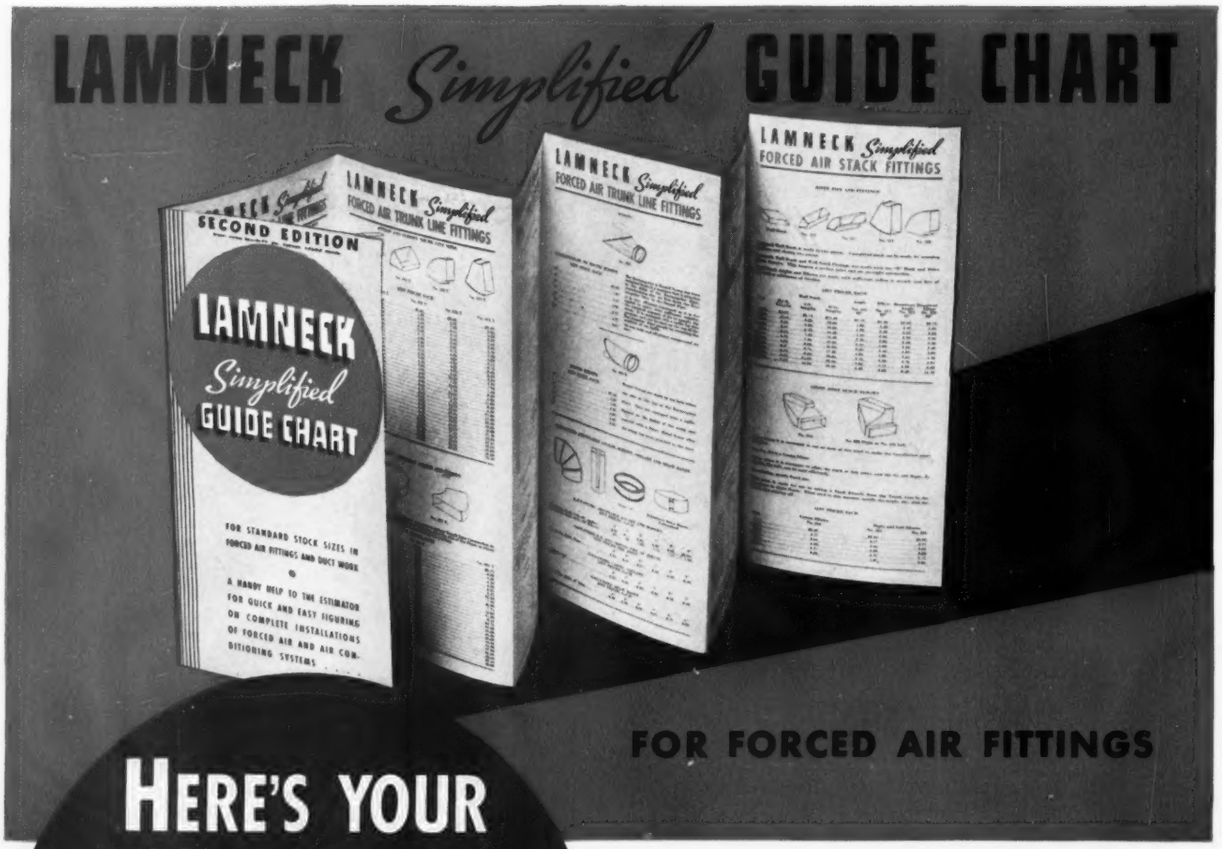
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WHEN we say it's *your* second edition of the Guide Chart we mean just that. The second edition was made necessary, first, because you folks in the field found the Guide Chart so useful that you entirely exhausted our large first edition in spite of two substantial reprints.

Again *you* sent us so many good ideas and suggestions for improving this popular service feature that we just had to get out a second edition. And it's a *honey!*—principally because of *your* interest and co-operation.

We are happy to know that the first edition made such a hit, happier still to be able to issue a much better second edition with *your* help.

The Guide Chart covers 98% of all fittings required for residential installations. For the few specials occasionally specified, equivalent areas are easily worked out by substituting standard stock sizes of corresponding dimensions. Our large stock of standard sizes not only insures prompt delivery but makes possible substantial savings—according to actual reports, an average saving of more than 30% of installation cost. Write today for all the copies you want of the second edition, *free*. Then destroy all former copies. Take advantage of this service to save yourself work, time and money.

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REGISTERS AND SIMPLIFIED FURNACE PIPE AND FITTINGS FOR FORCED AIR AND AIR CONDITIONING SYSTEMS . . .

Ohio's 36th Annual Convention

THE 36th annual convention of the Ohio Sheet Metal & Roofing Contractors' Association, held March 10, 11 and 12, in Dayton, established new marks to shoot at in the way of attendance, general interest and number and variety of manufacturers and jobbers' displays.

Probably the highlight of the convention was the session devoted to discussion of codes, ordinances and licensing agreements for the industry. The surprising amount of interest shown by contractors from cities all over the state in the proposition of licensing installers was more than satisfied by the very concrete facts which members from Dayton, now operating under a licensing agreement, brought out in their talks and in answer to questions from the floor.

Social Security

In the absence of Edwin A. Scott, of Sheet Metal Worker, whose subject was the social security law, Secretary Davies of the Dayton Building Contractors Association, read Mr. Scott's paper and injected numerous remarks and explanations of his own. Mr. Davies and Mr. Scott explained the nine major sections of the social security act and explained how the taxes to support this legislation will be levied on all states indiscriminately, but that only those states which have a satisfactory state law will be entitled to refunds from the tax money collectors. Mr. Davies explained how the Federal government will disburse money through recognized state agencies in those states having acceptable acts.

Mr. Davies explained the unemployment insurance act whereunder employers of eight men or more, working in any part of any twenty weeks during the year, will pay a tax of 1 per cent in 1936, 2 per cent in 1937 and 3 per cent in 1938 and 3 per cent thereafter. Taxes received from states will be held in trust by the federal treasury and will be paid out upon demand through the recognized state agency when the state passes its acceptable law. Payment for unemployment compensation may vary according to the requirements of the individual state. Time between lapse of employment and beginning of payments will vary as will the amount of money to be paid to the unemployed individual. Mr. Davies explained that the old age insurance tax does not become effective until January 1, 1937, and increases one-half per cent per period until the final total of 3 per cent is reached. This tax is matched by a tax collected from the employees and Mr. Davies explained how by 1942 the total tax on the employer for old age compensation and unemployment insurance will total something like 9.3 per cent of the payroll. Old age insurance payments will vary from state to state.

In answer to questions from the floor, Mr. Davies pointed out that many of the problems connected with bookkeeping and employment records have not yet been solved and that it is perfectly possible that each employee may be fingerprinted or identified in some manner so that no matter where he may work, so long as he remains in this country, there will be a continuous record of his employment. Mr. Davies declared it is necessary for contractors to keep an adequate set of records to answer requests for information from the federal and state departments. The only feasible answer to the problem of records is that each contractor shall maintain such records as will enable him to immediately provide wage rate, total weekly, monthly or yearly wages, names, addresses and citizenship records for each employee.

Copper Roofs

Henry E. Voegeli of the American Brass Company, speaking on the subject of copper roofing, which he has used as a topic at several midwestern conventions this year, made the interesting assertion that house building is bound to increase remarkably in 1936 and 1937. Mr. Voegeli declared that the three principal parts of any residential structure are the foundation, the frame and the roof, and that the sheet metal industry must look to the roof for its future business in construction. The most satisfactory type of roof to be applied is the metal roof, he stated, and in this connection standing seam copper can be recommended to the homeowner as a durable, attractive and economical type of material. Mr. Voegeli explained research in 10 oz. copper roof of standing seam construction with standing seams placed approximately fourteen inches, center to center, and explained why 10 oz. copper satisfactorily backed up and stiffened by the standing seam is as durable for a house roof as the usual 16 oz. copper of wide standing seam construction on commercial roofs.

Roof Costs

Mr. Voegeli said that where 16 oz. copper may cost from forty to forty-two dollars a square installed, the 10 oz. copper roof recommended can be sold for twenty to twenty-six dollars a square installed, a price which compares very favorably with $\frac{3}{16}$-in. slate.

Mr. Voegeli showed samples of electro-plate copper and explained the manufacturing process for depositing copper in the electro-plating bath. He explained how this light-weight copper is used in place of roofing felt to make built-up roofing and further explained how the copper seems to maintain the pitch or tar in first class condition through long periods of time.

J. H. Newton of the local FHA office made the interesting statement that FHA legislation has been responsible for a very noticeable increase in reconstruction and remodelling for all types of buildings. He asserted FHA does

not wish to promote a building boom, but rather hopes to stimulate a steady volume of construction. Thirty-three million dollars a month is the present rate of construction under Title I and Title II of the FHA act. Mr. Newton asked the association to go on record as wishing the extension of FHA beyond April 1, 1936. He said that a law extending the act for one year and another law extending the act two years is now before Congress.

Mechanical Code

I. W. Rowell, Furblo Company, introducing A. R. Meiche who spoke on "Recent Developments in Air Conditioning" declared that the better business bureau in co-operation with ASH &VE has gone on record as backing a set of standards defining air conditioning. The purpose of this proposed set of standards is to eliminate the sale of "gadgets" which are claimed to do everything, but actually do only one thing and often times do that poorly.

Mr. Meiche outlined briefly the history of the standard code (now eleven years old) and made the assertion that at least to sixty-five per cent of all the dealers in the country the code means only 12, 60, 800, and too few contractors know the fundamental principles which lie behind the formation of the code factors. "If this fact is true," declared the speaker, "then this industry surely needs all the education it can get in the way of a more complete understanding of both the standard and the mechanical code, as well as much additional information on the underlying engineering principles behind these two codes.

"The trouble with using the code blindly is that contractors fall into the habit of applying only those rules which are obvious and overlook supplementary rules which cover such things as cold ceilings and cold floors." How the code can be used as a sales tool was outlined by Mr. Meiche in relating his experiences calling on customers with contractors. He explained how moving from room to room making measurements and calculations, he impresses the home owner with the importance of sound engineering, and how many of the important points of mechanical heating and air conditioning can be explained to the home owner as the rooms are being measured. Mr. Meiche showed Tables II, III and IV from the Mechanical Code and emphasized the flexibility of the tables and the other sections of the code.

Licensing Ordinances

Opening the discussion on codes and licensing agreements J. D. Wilder, AMERICAN ARTISAN, pointed out that at the present time there seems to be three major types of code in effect. The first might be termed a building code, varying in the extent of its provision from the very simple code which controls locations of buildings in accordance with fire lines, property lines and zoning. The second type of code is much like the first, excepting that it has provisions covering fire safety, recommendations for good chimney construction, installation of warm air risers and steam and hot water pipes, good and bad practice in chimney construction, and very frequently covers installation of oil burner types, filters, coal bins, and installation of furnace and boiler bonnets. While this second type of code is more comprehensive than the first, it still leaves much to be desired in the way of insuring good installation, declared the speaker.

The third type of code, which is the type desired by organizations working for licensing ordinances, may vary from the simple code similar to the codes described in the second classification up to the very comprehensive code similar to the Minneapolis ordinance, which itemizes calculations required for engineering and installation, covers by means of tables and charts all allowable velocities, register air temperatures, capacities; in short provides a very definite outline of just how a heating installation shall be engineered and installed.

The purpose of all licensing agreements is to insure that each installation shall be correctly engineered and installed and may be a real protection to the property owner. Mr. Wilder explained briefly how organizations are working through state and local fire marshals, through real estate operators, through councilmen who wish to see the general level of installations raised and stated that no ordinance is any better than its inspection. If inspection is lax the ordinance will be violated; if inspection is adequate, installations will be made according to the ordinance and will be a protection to the owner.

Dayton's Problems

John Barrett, contractor member of the Dayton examining board, declared that ordinance work began as a state proposition in Ohio some twelve years ago, but due to many problems was abandoned leaving it up to the individual cities to prepare their ordinance and work for its application. Dayton, explained Mr. Barrett, has a city manager. The manager was the first official sounded out. The fire and health hazards of poor installation were impressed upon the Dayton fire chief and upon physicians, and their co-operation was secured early in the work. The original Dayton ordinance was prepared by the local heating men, but officials wanted the code to conform in general with other codes and

(*Continued on page 77*)

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The Minneapolis Heating, Ventilating and Air Conditioning Ordinance [Part 6]

Oil Burner Installation

PART XIV

Section 1401. The construction, arrangement and manner of installation of all oil burners and oil burner equipment hereafter installed for use in connection with heating systems, and the alteration and repair hereafter of all oil burners and oil burner equipment used or to be used in connection with heating systems, shall conform to the following provisions.

1401.1. Oil Burners and Oil Burner Equipment Defined: For the purpose of this ordinance, the term "oil burner," shall mean any device, for use in connection with a heating system, designed to burn fuel oil having a flash point of 100 degrees Fahrenheit, or higher, as determined by the Tag Closed Tester in accordance with the method of test adopted by the American Society for Testing Materials (A.S.T.M. Designation D56-21), and having a fuel tank or container with a capacity of more than ten (10) gallons connected thereto. The term "oil burner equipment" shall include oil burners, as above defined, and all tanks, piping, pumps, control devices and accessories, connected to the burners.

This ordinance shall not apply to portable burners not requiring connection to a flue, such as oil stoves, oil heaters and oil lamps equipped with a wick or a mechanical device the movement of which is essential to flame adjustment.

Section 1402. Approval of Oil Burners: It shall be unlawful for any person, firm, corporation, or their agents, to install any oil burner until an application for approval of such make or type of burner, on a form such as set forth immediately hereafter, shall have been filed with the Department of Buildings and a "Certificate of Approval" of such burner issued by said Department. Said Department shall issue a Certificate of Approval or of Disapproval within thirty (30) days after the filing of any such application.

APPLICATION FOR CERTIFICATE OF APPROVAL

The undersigned hereby requests that a Certificate of Approval be issued for the oil burner described below:

1. Name of Burner.....
2. Name of Manufacturer.....
3. Address of Manufacturer.....
4. Kind of Fuel recommended for Burner .....
5. Length of time Burner has been on market.....
6. List approvals by States, Cities or recognized Laboratories: ..... Name ..... Date..... ....
7. Attach blueprint of assembly drawing showing construction of device, indicating moving parts, oil passages and air passages.

Application filed by..... .....

At Minneapolis, Minnesota, this .....day of....., 19..

1402.1. The Department of Buildings shall approve any oil burner listed by the Underwriters Laboratory or any other nationally recognized inspection board or laboratory. Oil burners not listed by the Underwriters Laboratory or any other nationally recognized board or laboratory shall not be approved until they have been inspected and tested by the Department of Buildings. This inspection and test shall cover arrangement of parts, suitability of material, strength of parts, electrical control, thermostatic arrangement, reliability of automatic features, positiveness of ignition and safeguards against flooding. In case the Department of Buildings does not feel that it is competent to make the above inspection and test they are hereby authorized to require that the applicant submit a report of such an inspection and test from a recognized laboratory.

1402.2. With a Certificate of Disapproval the Department of Buildings shall issue to the applicant and to the manufacturer of the device a clear and concise statement as to the reason or reasons for disapproval.

1402.3. (a) New application made after the issuance of a Certificate of Disapproval shall not be made until thirty (30) days from date of issue of said certificate.

(b) New application shall be accompanied by a clear and concise statement giving reasons for reconsideration based on information received with Certificate of Disapproval.

(c) The Department of Buildings shall act on new application as specified in Section 1402 and Sub-Sections 1402.1 and 1402.2.

1402.4. When making an application to the Department of Buildings for a Certificate of Approval such as above provided for, or a re-application for such a certificate after a previous issuance of a Certificate of Disapproval of the same make or type of burner, the applicant shall be required to pay to the Inspector of Buildings, in connection with each such application or re-application, a filing fee in the sum of Fifteen Dollars ($15.00). All such fees so collected under this ordinance shall be paid over to the City Treasurer, by the Inspector of Buildings, as soon after collection as practicable.

Section 1403. Installation of Used Oil Burners, Procedure Required: Any person licensed to install, alter, repair and service oil burners in the City of Minneapolis shall install a used burner for use in connection with a heating system only after he shall have furnished the Department of Buildings of said City with a statement that said oil burner has been put in first class operating condition, a letter from the purchaser acknowledging that said purchaser is buying a used oil burner, and a certificate from two (2) competent engineers, whose qualifications have been recognized by the Inspector of Buildings, that said engineers have inspected and approved said used burner.

Section 1404. Fuel Oil: The grade of fuel oil used with any burner shall be one which tests and experience have shown to be suitable for use with that burner. The oil shall have a flash point not less than 100 degrees Fahrenheit, determined as specified in Sub-Section 1401.1, and shall be free from acid, grit, and fibrous or other foreign matter likely to clog or injure the burners or valves.

1404.1. Commercial Standards: The commercial standards (grades 1, 2, 3, 4, 5 and 6) for domestic and industrial fuel oils, set up by the U. S. Federal Government, Department of Commerce, Bureau of Standards Bulletin CS 12-29 (issued November 7, 1929) shall constitute standard grades for fuel oil sold or delivered to oil burner plants within the City of Minneapolis, and it is hereby declared a violation of this ordinance for any person, firm or corporation to deliver or put into the storage tank of an oil burner plant a grade of oil inferior to that ordered by the purchaser.

Section 1405. Use of Non-Automatic Burners Limited: Oil burners which

are not equipped with automatic means for preventing abnormal discharge of oil at the burner, shall not be installed or operated in any location where a competent attendant will not be constantly on duty on the premises where the burner is located while the burner is in operation.

Section 1406. Gravity Feed to Burners: Gravity feed shall be used only with burners arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

1406.1. Gravity supply tanks shall not exceed 275 gallons individual capacity. Where more than one gravity supply tank is used, such tanks shall be connected to the feed pipe leading to the burner through a manually operated, approved three-way valve in such a way that only one tank can discharge its contents at a time.

1406.2. Where oil is supplied to the burner by gravity and a constant level device is not incorporated in the burner assembly or in an auxiliary tank used in connection with an automatic pump, an approved constant level device shall be installed in the oil feed line at the gravity tank or as close thereto as practicable. The vent opening of such constant level device shall be connected by piping or tubing to the gravity tank vent pipe.

Section 1407. Pressure Tank Feed shall be used only with burners arranged to prevent abnormal discharge of oil at the burner by automatic means specifically approved for the burner with which it is used.

Pressure tanks shall not exceed a capacity of 60 gallons, and shall not be operated at pressures exceeding 50 pounds per square inch. They shall be equipped with a reliable pressure gauge, and with an automatic relief valve piped to discharge outside of buildings.

Section 1408. Installation of Underground Tanks: Underground tanks shall be so buried as to have a cover of earth not less than 2 feet thick, or shall be covered with not less than 1 foot of earth on top of which shall be placed a slab of reinforced concrete not less than 4 inches thick. The slab shall be set on a firm, well tamped earth foundation and shall extend at least 1 foot beyond the tank in all directions. Where tanks are buried underneath buildings such a concrete slab shall be provided in every instance.

1408.1. Underground tanks shall be set on a firm foundation and surrounded with soft earth or sand well tamped in place. Where necessary to prevent floating they shall be securely anchored or weighted.

Section 1409. Installation of Tanks Inside Buildings: Oil supply tanks larger than 60 gallons capacity shall not be located in buildings above the lowest story, cellar or basement.

1409.1. Unenclosed inside storage tanks and auxiliary tanks shall not be located within 5 feet, horizontally, of any fire or flame.

1409.2. Inside storage and auxiliary tanks shall be securely supported by substantial incombustible supports to prevent settling or sliding.

1409.3. Oil supply tanks located inside buildings shall not exceed 275 gallons individual capacity or 550 gallons aggregate capacity (in one building) unless installed in an enclosure or casing constructed as follows:

The walls of the enclosure shall be constructed of reinforced concrete at least 6 inches thick or of brick at least 8 inches thick, and shall be bonded to the floor. The space between the tank and the enclosure shall be completely filled with sand or well tamped earth. Where the floor or other construction immediately above the tank is of fire-resistive construction capable of safely sustaining a load of 150 pounds per square foot, the walls of the enclosure shall be carried to a height not less than 1 foot above the tank and the space filled with sand or well tamped earth to the top; otherwise the enclosure shall have a top of reinforced concrete at least 5 inches thick or of equivalent construction.

Instead of an enclosure as above described the tank may be encased in reinforced concrete not less than 6 inches in thickness, applied directly to the tank so as to completely eliminate any air space.

1409.4 In buildings of ordinary construction the nominal gross capacity of tanks shall not exceed 5,000 gallons.

1409.5. In fire-resistive buildings the nominal gross capacity of tanks shall not exceed 15,000 gallons.

1409.6. In any building, if in a fire-resistive or detached room cut off vertically and horizontally, in an approved manner, from other floors of the main building, the nominal gross capacity of tanks shall not exceed 50,000 gallons, with an individual tank capacity not exceeding 25,000 gallons.

Section 1410. Construction of Tanks: Underground tanks and tanks inside of buildings shall be constructed of steel or wrought iron of a minimum gauge (U. S. Standard) in accordance with the following table, except that for tanks of 181 to 275 gallons capacity, installed in buildings, and without masonry enclosures the minimum gauge shall be No. 14. Steel or wrought iron thinner than No. 7 gauge used in the construction of underground and enclosed tanks shall be galvanized.

Capacity, Gals.	Minimum Thickness	Weight Lbs. per sq. ft.
7 to 285	16 gauge	2.50
286 to 560	14 gauge	3.125
561 to 1,100	12 gauge	4.375
1,101 to 4,000	7 gauge	7.50
4,001 to 12,000	¼ in. (nom.)	10.00
12,001 to 20,000	5-16 in. (nom.)	12.50
20,001 to 30,000	⅜ in. (nom.)	15.00

If adequate internal bracing is provided tanks of 12,001 to 30,000 gallons capacity may be built of ¼-inch plate. For tanks larger than 1,100 gallons capacity, a tolerance of 10 per cent in capacity is permitted.

1410.1 Joints shall be riveted and calked, brazed, welded or made tight by some equally satisfactory process. Tanks shall be tight and sufficiently strong to bear without injury the most severe strains to which they may be subjected in practice. Shells of tanks shall be properly reinforced where connections are made. All connections to underground tanks and tanks inside buildings shall be made through the top of tank above the liquid level, except that tanks of not over 275 gallons capacity may have one bottom connection for gravity feed and one opening for an approved key stem gate valve to facilitate cleaning or for a scavenging line to be run to the outside and capped oil tight when not in use.

1410.2 Pressure tanks shall be designed for at least six times the maximum working pressure.

1410.3 Tanks shall be thoroughly coated on the outside with tar, asphaltum, or other suitable rust-resisting paint. Where placed in corrosive soil special protection may be required.

Note: Tanks labeled by Underwriters' Laboratories have been tested and examined for compliance with these regulations and detail standards covering their design and construction.

1410.4 For fuel oil heavier than 35° A. P. I., tanks may be made of concrete, in accordance with the Regulations of the National Board of Fire Underwriters for the Construction of Concrete Fuel Oil Storage Tanks as recommended by the National Fire Protection Association.

Section 1411 Tank Vents: Storage tanks shall be equipped with an open vent or an approved automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than 1¼-inch pipe size.

1411.1 Vent pipes shall be arranged to drain to the tank. The lower end of the vent pipe shall not extend through the top into the tank for a distance of more than one inch.

1411.2 Vent pipes shall terminate outside of buildings at a point not less than 2 feet measured vertically or horizontally from any window or other building opening and not less than one (1) foot above fill cap, nor less than two (2) feet above the ground. Outer ends of vent pipes shall be provided with a weatherproof hood. Vent pipes of tanks containing heaters shall be extended to such a height that oil vapors discharging from the vent will be readily diffused without danger of ignition.

(*Continued on page* 80)

Photo: N. B. Aukerman

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EVERYBODY admires pearls. Few know how to distinguish the rare from the common, the genuine from the imitation. The best guaranty of genuineness and value one has is the name of the firm of which they are bought.

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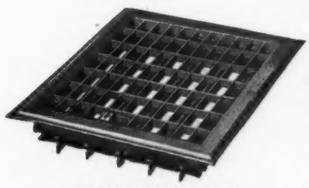

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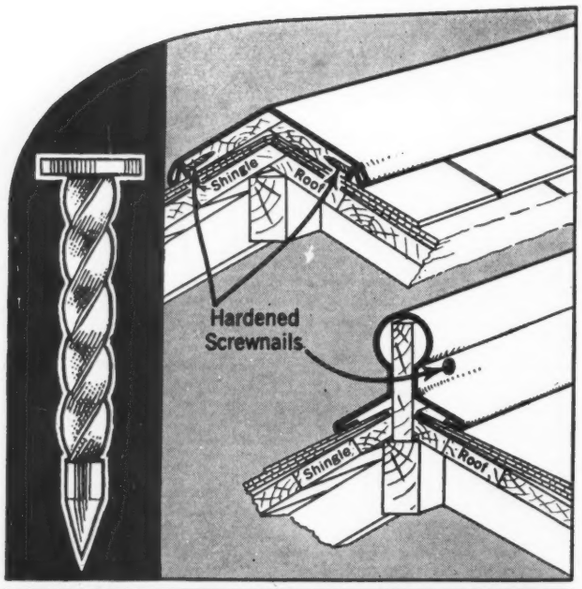

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New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 74.

223—Copper Shingles Booklet

A new booklet entitled "Copper Roofs" together with supplementary information is announced by the New Haven Copper Company, Seymour, Connecticut. What copper roofs mean to the sheet metal and roofing contractor is explained. Application of copper to residence and commercial buildings, current advertising on copper roofs in popular magazines, and suggested methods for increasing or making sales of copper roofs is presented in the first booklet. What the average home owner wants in the way of a roof, the twelve predominant advantages of the copper roof, suggestions covering suitable answers to objections, and a step by step sales presentation comprises a supplementary bulletin entitled "How to Sell Copper Roofs." Another booklet covers typical questions and answers such as guarantees, installing copper over wood shingles, waterproofness, discoloration, are copper roofs hot, copper on flat roofs, application of insulation, are covered in a supplement. The company has also prepared sets of instructions covering application and a number of very handsome photographs of houses roofed with copper shingles.

◆

224—Metals and Alloys in Pharmaceuticals

A new bulletin, semi-technical in nature on the use of various metals and alloys for equipment in the manufacture of pharmaceuticals and fine chemicals has just been issued by the technical service department of The International Nickel Company.

Several new materials are described in the bulletin, among them being K monel, a hardenable alloy made from Monel Metal by introducing small quantities of aluminum. Data on Monel Metal, in cast and rolled form, and on nickel also are given. The bulletin is illustrated throughout.

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225—Velometer Leaflet

Illinois Testing Laboratories, Inc., 141 W. Austin Avenue, Chicago, Illinois, announces Bulletin No. 2448, describing the company's "Alnor" Velometer, an instantaneous, direct reading, air velocity meter. This unit reads velocities directly by means of electrical operation. Various types of the unit and supplementary apparatus, which is used for different types of air reading, are shown and explained. Photographs show suggested methods of using the instrument for different readings and explain briefly just how the instrument operates.

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226—Furnace Leaflet

Quist Furnace and Manufacturing Company, Milwaukee, Wisconsin, announce a new four-page leaflet in color, showing and describing the Quist steel furnace. The furnace consists of a steel shell of rectangular shape, with a rectangular radiator. The leaflet gives full information on the gages of metal used, methods for making the unit air and gas tight, with additional information on such special features as the collar connections, grates, firing door and radiator.

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227—Humidifier Leaflet

The Monmouth Products Co., 201 East 131st street, Cleveland, Ohio, announces a new folder showing and describing the features of automatic June hydro-electric humidifying system. The folder shows the construction of the pan and the evaporating plates. Data shows a comparison of evaporating capacities with and without plates. Text matter explains the advantages of adjustable evaporating capacity together with full information on the material used in the evaporating plates. The water supply mechanism, proper mounting of the pan, and control are explained in detail.

New Literature . . . .

228—Protective Paper for Bright Metal

American Nickeloid Company, Peru, Illinois, some time ago introduced a method for protecting bright metal by means of an adhesive gummed paper. The purpose of the paper is to protect the metal from scratches and marring while fabricating. The company now introduces two folders to show some of the advantages of paper-adhered protection. The first folder contains a small sample of bright metal with the paper in place and explains how the sheet should be handled with the paper in place and what finishing operations should be followed when the paper is removed.

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229—Air Conditioning Folder

Entitled "Air Conditioning as a Business Builder," a new eight-page folder has been distributed to dealers by Kelvinator Corporation. The purpose of the folder is to tell owners of business enterprises how air conditioning attracts and holds patronage, and helps to overcome the hot weather slumps that are now so unprofitable to many types of businesses. The value of air conditioning for stores of every kind, restaurants, beauty shops, dance halls, bowling alleys, billiard rooms, cocktail bars and other service establishments is told in picture and copy in this folder.

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230—Turret Punch Leaflet

Wiedemann Machine Company, 1815 Sedgley Avenue, Philadelphia, announces a leaflet showing and describing their Type R-5 heavy duty motor-driven turret punch. Complete description of the unit and its operating characteristics are presented.

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231—Night Air Fan Bulletin

The Peerless Electric Company, Warren, Ohio, have fully described their new Night Air Cooling Fan in bulletin No. 208. A unique method of suspension is used to prevent any rotational torque effect being transmitted to the rooms below. Closely guarded to insure safety to children where attic is easily accessible, the special slow speed belt driven fan is provided with adjustable speeds to meet all installation requirements. The same motor and automatic belt tension device used on Peerless blowers is standard equipment.

◆

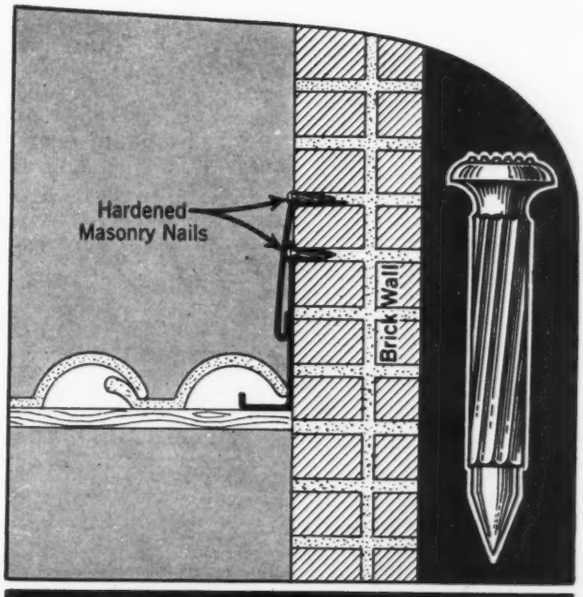
232—Machinery Catalogs

The Peck, Stow & Wilcox Co., Southington, Connecticut, announces Bulletin A-10, Series 2, covering power squaring shears. Features of design and operation for the various units are shown by means of photographs, drawings and text. Dimensions, capacities and operating characteristics are presented in tabular form. The company also announces catalog No. 35A, covering machines and tools for sheet metal work. Illustrations and complete descriptions are given for all types of folders, shears, brakes, formers, burring, flanging and seaming machines, punches, and hand tools.

◆

233—Copper Membrane Catalog

CopperKote membrane, a combination of the Brownskin waterproof sheathing and a layer of thin sheet copper, the two materials being bonded together with asphalt, is announced by the Cheney Company, Architects Building, Philadelphia, Pennsylvania. The sheathing is 45-pound kraft paper impregnated with a bituminous compound and covered with either one ounce or two ounce thin copper. The material is designed for application in masonry walls as a protecting membrane waterproofing or flashing. It is said to be especially convenient for waterproofing around window and door openings and is furnished in rolls 120 feet long and standard widths of 30 and 40 inches. The leaflet shows the construction of the new membrane and typical applications.



HARDENED MASONRY NAILS

CUTS Expenses on Masonry Fastenings

For use in Brick, Mortar, Concrete

Developed especially for the work, Hardened Masonry Nails save time, labor and money in making fastenings to brick, mortar, concrete or cinder blocks.

You drive these Nails into mortar and cinder blocks just as you drive common nails into wood. And, even in making fastenings to harder substances like brick and seasoned concrete you need to drill only a small starting hole. Nothing could be simpler.

Hardened Masonry Nails are cheaper to buy, as well as cheaper to use than ordinary devices such as expansion bolts, hooks and anchors. They make secure fastenings, too.

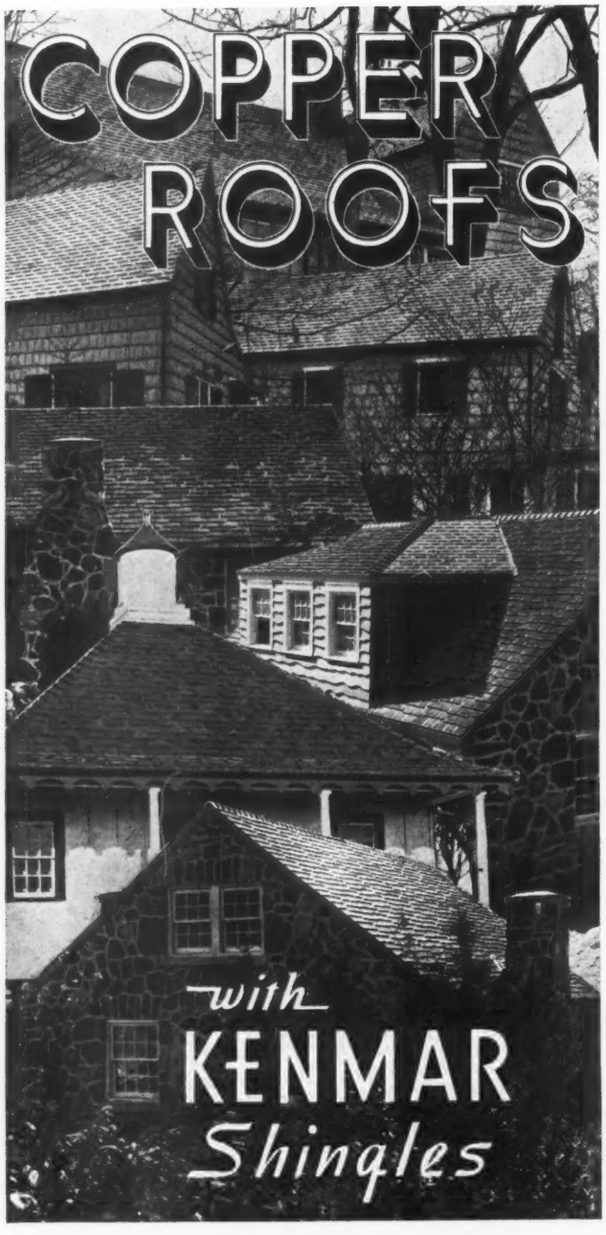
Mail the coupon for FREE SAMPLES. Give Masonry Nails a trial. See what they will save.

PRODUCT OF

PARKER-KALON CORPORATION

Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Send me free samples of Hardened Masonry Nails.
Name.....
Address.....
.....

SOLD ONLY BY RECOGNIZED DISTRIBUTORS



Put Metal out in front as a roofing material

Kenmar Copper Shingles are creating a stir in the building field. Copper is now architecturally attractive for *any pitched roof.*

New profits for you

You can share in this big new market. Widen your field. Step up your profits. Write for details and sales plan for roofing contractors.

The New Haven Copper Co.
MANUFACTURERS OF SHEET COPPER SINCE 1849
Seymour, Conn.

New Literature . . . .

234—Sizes We Roll

The Inland Steel Company, Chicago, has just published a new edition of their handy booklet, "Sizes we Roll." It includes complete size data on all sheets, strip, bars, plates, structurals, and semi-finished steel produced by Inland, and also several reference tables useful in ordering steel.

◆

235—Stainless Steel Booklet

The beauty, popularity and enduring radiance of stainless steel is interestingly presented in a new seven color booklet prepared by Joseph T. Ryerson & Son, Inc. This new booklet photographically presents dozens of stainless articles and shows Allegheny Stainless Steel applications in all lines of industry.

It demonstrates the increasing popularity of stainless steel for all types of products—Also its use in equipment and production machinery where longer life and improved processes are factors.

◆

236—Sleeve Clutch Leaflet

Niagara Machine & Tool Works, Buffalo, New York, announce a four-page leaflet covering the new Niagara 14-point engagement sleeve clutch for Niagara power presses. The construction of the clutch and the operating and design characteristics are shown by means of photographs accompanied by full explanation.

◆

237—1936 Fan Catalog

Emerson Electric Mfg. Company, St. Louis, Missouri, announce the new 1936 Emerson fan catalog, No. X1149, and also a new catalog No. X1150. These catalogs cover the company's new line of desk fans in many sizes, also window or transom ventilators or built-in ventilators for kitchen use. Several radically new types of fans are announced for the first time in these catalogs.

◆

238—Air Conditioning Catalog

A revised edition of the Russell Electric Company four-unit Hold Heet air conditioning catalog is announced. As in the former catalog, views and descriptive material are presented covering the Hold-Heet air conditioner for boiler connection, air conditioners for furnace systems, room-type conductors, unit heaters, attic ventilating fans and the complete line of Russell control apparatus. Information on the construction of each unit is accompanied by price quotations.

FOR YOUR CONVENIENCE

American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Check numbers in which you are interested):

20	21	22	23	24	25
26	27	28	29	30	
223	224	225	226	227	228
229	230	231	232	233	234
235	236	237	238		

Name ..... **Title** .....

Company ....

Address .....

With the Manufacturers . . .

Wrieden Becomes Lennox Sales Manager

D. W. Norris, president, Lennox Furnace Co., announces that effective April 6, A. W. Wrieden became sales manager and will direct all sales work of the two plants—Marshalltown and Syracuse. For twelve years Mr. Wrieden was a sales executive and treasurer of the Holland Furnace Company and for the last two years manager of the code authority of the Warm Air Furnace Institute. Messrs. R. T. Wasson and C. H. Schechter will continue as assistant sales managers of western and eastern areas as formerly.

◆

Fox Holds School

A group of 145 jobbers, jobbers' salesmen and heating contractors attended The Sunbeam Air Conditioning School at Boston, Mass., March 10 to 13 inclusive.

Two days were devoted to the discussion of engineering problems encountered in calculating requirements for an air conditioning system. All "students" were given, and completed, the task of calculating, designing and sizing an air conditioning system for a typical residence, building plans for which were provided. During the balance of the session were covered such topics as cooling, making of ducts, installations, sales and advertising. This is one of a series of engineering schools being conducted.

◆

J. M. & L. A. Osborn Elects Officers

The annual stockholders' meeting of the J. M. & L. A. Osborn Company was held on January 23rd, at which the following directors were elected: A. W. Howe, J. W. Harrison, C. A. Nenno, J. T. Hagan, W. B. Osborn, C. E. Caddy and G. F. Climo.

At a later meeting, the board elected the same officers who have served during the past year, namely: A. W. Howe, President and General Manager; C. A. Nenno, Executive Vice President; J. W. Harrison, Secretary-Treasurer.

◆

Star Supply Opens Roofing Plant

Nathan Fishman, President of Star Steel Supply Co., Detroit, Mich., announces the formation of a new company (the Federal Asphalt Products Company, 5620 Federal Street, Detroit) to engage in the manufacture of a complete line of asphalt roofing products. All equipment is new and modern and production started March 10.

◆

Fan Association Elects Officers

A year of rapidly increasing business and sales volume for the ventilation and air conditioning industry during 1936 was forecast by members of the National Association of Fan Manufacturers during their annual meeting, held at the Palmer House, Chicago, January 29, co-incident with the mid-winter meeting of the American Society of Heating and Ventilating Engineers.

The following officers were elected for the coming year: President, John M. Frank, Ilg Electric Ventilating Co., Chicago; Vice-President, Fred Herlan, B. F. Sturtevant Co.; Secretary, L. O. Monroe, Detroit.

◆

American Brass at Oil Show

The American Brass Company exhibit will occupy spaces 334 and 336 at the Twelfth National Oil Burner Show.

The most prominent portion of the display will be copper tubes for oil burner installations with flared tube fittings and copper tube for hot water and low pressure steam lines with solder fittings. The tube exhibit will also include small diameter tube manufactured by the French Small Tube Branch and flexible seamless metal tube fabricated by The American Metal Hose Branch.

"I had no idea one machine of any kind could be so useful"

• "We have a sheet metal shop, tin shop to most people, and work mostly galvanized sheet iron 30 to 12 gauge. About 8 months ago I saw a Lincoln advertisement in_____ and decided to try out the Lincoln welder 'SA 75.' We had never used a welding machine and had never given it a thought, as all of our work was either lock joint or riveted and soldered. However, we bought one and had a welder demonstrate and explain to one of our men how to use the machine. Today that man who had never struck an arc before in his life up to 8 months ago and without any special effort or training has become one of the best galvanized sheet iron welders I have ever seen.

"I had no idea that one machine of any kind could be so useful. I wouldn't sell it for twice the cost if it were not possible to purchase another just like it.

"Put us down on your list as Lincoln boosters 100%."

(*Signed*) GEORGE BOOTH, Beaumont, Texas

• Have *you* investigated this profitable machine? By all means do! To weld, all you have to do is press a button. The electric arc is always on hand—never any delay. And it costs less than a nickel an hour to use.

You can buy one of these Lincoln welders for as little as $250.

Mail the coupon today for details. THE LINCOLN ELECTRIC COMPANY, Department EE-222, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

★ MAIL THIS COUPON TODAY ★

THE LINCOLN ELECTRIC CO., Dept. EE-222, Cleveland, Ohio

Gentlemen: Please send me full particulars on the new $250 Lincoln welder. I now weld with electric arc ☐ gas ☐.

Firm Name _____

Your Name _____ Title _____

Address _____

City _____ State _____

MONCRIEF GIVES THIS KIND OF MONEY-MAKING HELP TO US DEALERS—

New Spring House-to-House Circular—Ready Soon

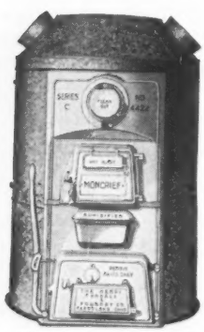
SEND FOR SAMPLE

Effective literature and sales promotion material for dealers is an important part of the Moncrief Plan of Dealer Helps—a plan which recognizes that our dealers must prosper as well as we.

This new spring 4-page house-to-house circular helps the dealer sell furnace cleaning and repairs early in the season. It helps him get into the home to inspect the heating plant so he can sell his services and suggest new equipment. Approximately one-half of the first page is devoted to the dealer's own ad.

If a strong dealer help plan appeals to you—if you see how it will make more money for you—you should know more about the Moncrief Proposition. Why not write today for all the facts?

THE HENRY FURNACE & FOUNDRY CO.
3473 E. 49TH ST. CLEVELAND, OHIO



Moncrief Series "C" Cast Furnace

Moncrief Has Everything for the Progressive Dealer

A complete line of furnaces and air conditioners for coal, gas or oil—air conditioning equipment — warm air and air conditioning pipe and fittings. Made to fit any need—any pocketbook.

With the Manufacturers . . .

Inland Steel Changes

Benjamin C. Bradford, district sales manager of Inland Steel Company's St. Paul, Minnesota, office for the past thirty-two years, is retiring early in January.

Ervin J. Sanne has been appointed successor as District Sales Manager at St. Paul.

◆

Revere Announces Consolidations

The Baltimore Division and Baltimore Tube Co. Division of Revere Copper and Brass, Incorporated, have been consolidated and hereafter will operate as the Baltimore Division. Sales offices are at 1301 Wicomico Street, Baltimore, Md. Branch offices of this division are located in Philadelphia, Atlanta and New Orleans. R. S. Stringer is Vice-President of Revere's Baltimore Division and R. H. Hodges, Sales Manager.

◆

Rudy Advertising and Sales Campaign

The Rudy Furnace Company, Dowagiac, Michigan, announces that dealer schools are being held in all parts of the country with the exception of the far West. At these schools, an engineering manual with a simplified method of figuring gravity and forced air installation is presented. The company has prepared elaborate material for use in the schools and for use by Rudy dealers. A manual "How to Get Prospects" gives more than fifty methods which have been used successfully. At each school a complete installation is sold by the factory representative. The company has prepared a very elaborate brochure entitled "Balanced Atmosphere" which presents the complete story of air-conditioning products manufactured by the Rudy company, the personnel of the company and striking pictures taken in the factory of various operations gives interesting inside views of manufacturing processes. The history of heating from the day of the open fire through the fireplace, stove, pipeless furnace, up to modern air-conditioning apparatus, is presented. Features of design of Rudy apparatus presented in detailed photographs, drawings and cutaway views explain the proper method of using Rudy equipment. Air conditioning is explained in simple language and by means of drawings so that the home owner may visualize just what he is purchasing.

Another booklet entitled "How to Use the Sales Manual" discusses all the aspects of canvassing and sales. Typical objections with replies are presented.

Investigating credit, suitable display, proposals, plans, features of apparatus, are discussed in "How to Get Prospects." Old and new customers, house to house canvassing, what the canvasser and salesman should say, telephone solicitation, newspaper advertising, phone book advertising, radio announcements, hand bills, postcards, fliers, letters, are a few of the many sales plans which are presented in detail. The engineering data book is a complete presentation of the engineering involved in gravity, mechanical heating and air-conditioning systems.

◆

Republic Steel Appointments

Charles W. East has been appointed District Sales Manager of Republic Steel Corporation at Houston, Texas. Mr. East leaves his post as Assistant Manager of Sales in Republic's Pipe Division immediately to establish his headquarters in Houston.

The appointment of R. H. Sonneborn as Special Sales Representative of the Tubular Division is also announced. Mr. Sonneborn will have headquarters in the Republic Building, Cleveland, Ohio.

◆

Independent Filter Opens N. Y. Office

The Independent Air Filter Company, 215 West Ohio Street, Chicago, Illinois, announces the opening of a new office in New York City at 55 West 42nd Street. Henry Gitterman will be the representative.

Ohio Convention

(*Continued from page* 68)

this resulted in numerous changes. Mr. Barrett explained some of the loopholes in the present ordinance which must be eliminated before complete success is assured. One of these loopholes is the allowing of building and loan associations to establish and maintain a heating and repair department, permitting the loan association to install furnaces, repair heating plants, repair and install roofs; in short, to do the work which our industry should do.

A critical problem in the Dayton ordinance was the original establishment of a $75 per year licensing fee which was later reduced to $25 per year in order to meet objections of many of the small operators. Mr. Barrett explained that no ordinance stands a chance of adoption if the ordinance seems to prevent the small operator from remaining in business. He further explained that it remains for yearly examinations or for the inspector who finds a violation of the agreement to eventually eliminate the operator who does not wish to abide by the provisions of the code.

Otto Young, second member of the examining board, outlined briefly some of the preliminary steps which were taken to secure the backing of city officials and interested property owners. He declared that an ordinance represents a large amount of time and effort and that any organization wanting an ordinance must make up its mind that success hinges largely on the preliminary ground work.

In answer to questions from the floor, Mr. Barrett and Mr. Young gave some idea as to the amount of cost involved in securing passage of the ordinance; gave a very excellent resumé of the type of sales argument used on various city officials; and outlined some of the changes which they would make if the ordinance was now up for passage. Mr. Barrett and Mr. Young said they would be very happy to cooperate with other contractors in different cities of Ohio, working for licensing ordinances, and will be glad to answer correspondence.

Stainless Steel

J. C. Butterfield of American Rolling Mill Company, speaking on the general subject of stainless steel, said that the first uses of stainless steel were in cutlery, but that its use has spread primarily because of the material's durability and attractiveness. Sheets were first introduced in America in 1926 and were used in 1930 and 1931 on some of the largest buildings in the country. Stainless steel remains bright because the chromium unites with oxygen to form a film over the surface and it is only when this film is broken that rusting can appear. The speaker declared that in fabricating stainless steel, all marks of the machines may be removed usually by washing the material after forming with a 10 per cent, 130 deg. solution of nitric acid. Because the usual stainless steel is from 50 to 400

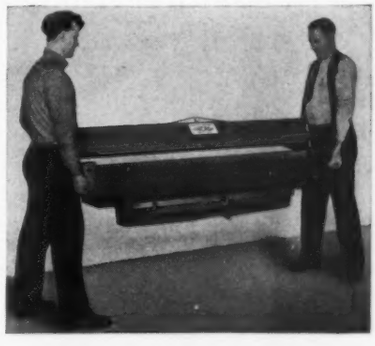
(*Continued on page* 82)

ANNOUNCING NEW PORTABLE CHICAGO STEEL BENDING BRAKE

One Man Can Set It Up

Just bring hinged legs to upright position and lock with convenient thumb screws. No loose parts to mislay. Brake always remains firmly in place without bolting to floor.

BUILT to fill a definite need in air conditioning work—will bend and flatten 1/4 in. or wider seam on 22 gauge; will bend 1/2 in. flange or wider on 20 gauge—half the weight of regular brake with maximum strength — perfect for use on small job as well as large one, ideal for general shop use.



Two Men Can Carry It

Easy to truck right to the job. Legs are hinged to swing up and make very compact piece to carry. Clamping handles are made to be used for carrying. Top and bottom sections are one-piece embossed steel plates to give greatest strength with minimum weight. Bending leaf consists of solid plate reinforced with specially formed plate.

Size	Code	Bending Length	Capacity	Overall Length	Net Weight	Shipping Weight	Price f.o.b. Chgo.
420	Odluw	49 in.	20 ga.	62 in.	320 lbs.	355 lbs.	$ 95.00
520	Oduct	61 in.	20 ga.	74 in.	360 lbs.	400 lbs.	100.00

Both sizes—Overall width 24", Overall height folded 28", set up 44".

Write for full details. A money-maker for every job.

DREIS & KRUMP MFG. CO.
7400 Loomis Blvd., Chicago

Letters From Readers

Editor,
American Artisan:

To get away from roofing and sheet metal I took an ocean trip, but five minutes after landing in the Virgin Islands, U. S. A., I was talking shop.

Atop a twenty foot ladder a colored colleague of the profession was repairing a gutter. At the foot of the ladder, his helper, like helpers the world over, dozed comfortably in the tropical sun.

"Say," I yelled up to the boss, "I'm in the same business you are back in

Iron roofs to the right—iron roofs to the left—a view of St. Thomas.

the States. What do you call your trade down here?"

"Tinsmith," came the reply in a deep modulated voice with strong British inflection.

Theodore Cassimere walked me over to his shop with its large swinging door, characteristic of all the business

" . . . Mechanics the world over take their ease."

houses on the Island. He willingly posed at his bench with hammer in hand as I backed away, focusing my camera.

Theodore, to save money, makes all his own gutter in three-foot sections on a three-foot beader and then solders the pieces together. He also makes his own gutter hangers from ½ in. x 1½ in. band iron. He has two types of hangers—one for driving into masonry and another for screwing to wood.

"That roof," said I pointing across the street, "must have been painted last year." After a scrutinizing glance Theodore replied, "No, I'd say about 7 or 8 years ago."

That was interesting. I questioned further. "How long does your 26-

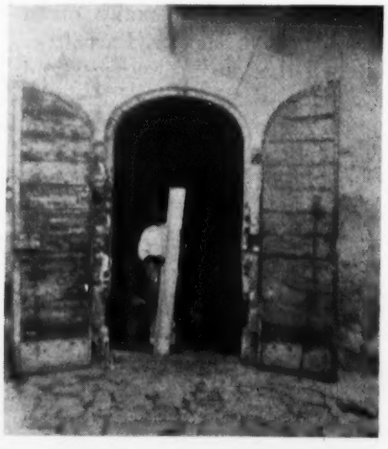
Gutters to carry precious rain water even run across streets.

gauge galvanized iron last down here?" "Well," he drawled, "when I first started some 48 years ago I put up gutters that are still good."

One wondering why things are done so slowly in the tropics often blames the heat, but forgetting the temperature, here we have two interesting facts.

In Washington, where I have my shop, roofs are painted every two to three years. Galvanized gutters and spouts are replaced because of rust within 7 to 10 years. In the same period of years where I will have from five to twenty jobs, Theodore has but one.

Corrugated iron roofs are used everywhere. They have completely supplanted shingles because they give better service. Their only danger is that during a cyclone a flying sheet may cut off someone's head, but provided they are not blown out to sea, the sheets can be picked up and used again.



Theodore makes his gutter in 3-foot sections and solders them together.

There are a number of tin roofs that are in fine condition dating from the time Denmark owned the Island. They are made of 10 in. x 14 in. sheets, locked and maletted together with no solder used anywheres. After application they were substantially painted.

Theodore, not having seen any tin for a good many years was under the impression that it was difficult to get a hold of.

Those who believe only they are troubled with trade disputes may be amused to learn that the Virgin Islander also has his problems. In the debate between the Metal Men and the Iron Workers in Washington as to who should erect corrugated sheets, when they came in contact with iron, the Ironmen won. In the contest between the roofers and the carpenters in the Islands as to who should erect corrugated iron when it came in contact with wood the roofers won. Their argument was that if a carpenter punches a sheet in the wrong place he

(*Continued on page* 81)

WISE FURNACES . . .

and *Wise* DEALERS

WISE Furnaces back up their efficiency, durability and economical operation with a name almost as old as the industry itself. Many have been giving excellent service for well over thirty years. Dealers who started with WISE are still handling and *selling* WISE, and here are the reasons — They know that they can expect more service per furnace — that they can assure their customers the ultimate in performance — that WISE backs them up to the limit—and that they have an outstanding furnace deal that *always* returns handsome profits.

The new Series "A" has features that the trade can really sell.

● A new one-piece self-cleaning radiator—provides larger combustion chamber and more prime heating surface . . . and will not fill up with soot and dirt. ● A new ashpit and lower front—eliminates joints, makes installations easier and assures permanent, perfect alignment of fronts.

● One-piece cellular fire-pot — proved by University tests to be at least 9% more efficient than the solid type. ● Assures a permanent domestic hot water supply (available at slight extra cost).

Furnace dealers can cash in on the old, reliable WISE name and at the same time sell a furnace that tops all others with new features that cannot be successfully duplicated. Write TODAY for free literature and convincing, dynamic sales helps.

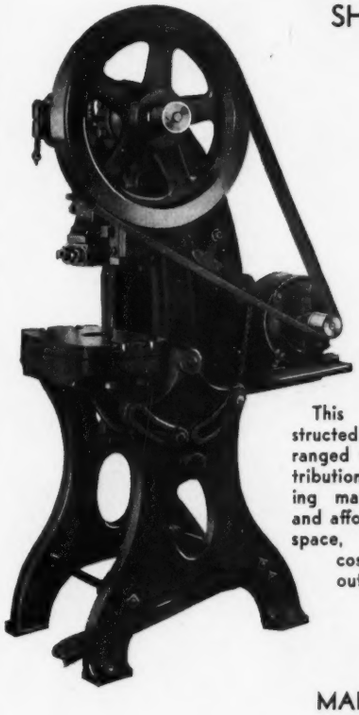
WISE FURNACE CO.

AKRON, OHIO

The MARSHALLTOWN *Line*

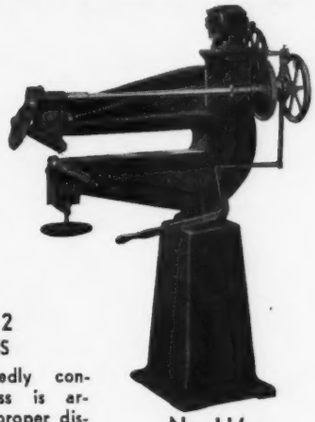
MARSHALLTOWN IOWA, U.S.A. MFG. CO.

PRESSES—Capacities from 10 ton to 70 ton.
SHEARS—Capacities 18 gauge to 1/2" plate.



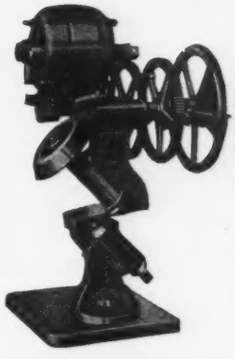
No. 2 PRESS

This ruggedly constructed Press is arranged with proper distribution of weight giving maximum strength and affording ample die space, low operating cost and increased output.



No. 116 THROAT SHEAR

Is especially designed for Cutting Inside Circles and Irregular Shapes.



No. 18 MOTOR POWER THROATLESS SHEAR

Complete with 1/8 HP standard motor, self-feeding and easy to operate.

No. 18 HAND POWER THROATLESS SHEAR

For irregular cutting or straight splitting of 18 gauge sheets or lighter. Will cut sheets of any dimensions.

Ask Your Jobber or Write

MARSHALLTOWN MANUFACTURING CO.

MARSHALLTOWN IOWA

Minneapolis Code

(Continued from page 70)

1411.3 Vent pipes shall not be cross-connected with fill pipes or return lines from burners.

Section 1412 Tank Fill and Overflow Pipes: Underground tanks and storage tanks inside buildings shall be filled only through fill pipes terminating outside of buildings at a point at least 2 feet from any building opening at the same or lower level. Fill terminals shall be closed tight, when not in use, by a metal cover designed to prevent tampering.

1412.1 Auxiliary tanks shall be filled by pumping from storage tanks.

1412.2 Auxiliary tanks other than vacuum tanks shall be equipped with an overflow pipe draining to the storage tank, at least one size larger than the supply pipe.

1412.3 Overflow pipes of auxiliary gravity tanks shall have no valves or obstructions. Overflow pipes of auxiliary pressure tanks shall be provided with inter-connected valves or other means for automatically venting the tank during filling.

Section 1413 Oil Gauging: All tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with an approved method of determining the oil level.

1413.1 Test wells shall not be installed inside buildings and where permitted for outside services shall be closed tight when not in use by a metal cover designed to prevent tampering.

1413.2 Gauging devices such as liquid level indicators or signals shall be installed so that oil or vapor will not be discharged into the building from the fuel supply system.

1413.3 No glass gauge, or any gauge the breaking of which will permit oil to escape from the tank shall be used.

Section 1414 Oil Pumps: Oil pumps shall be of approved type, secure against leaks, and shall be rigidly fastened in place.

1414.1 Automatic pumps not an integral part of the burner shall be arranged to stop automatically in case of total breakage of the supply line to the burner.

1414.2 In isolated locations, where fire protection equipment is dependent upon a heating plant fired by an oil burner, oil pumps supplying the burner shall be installed in duplicate.

Section 1415 Piping: All piping shall be standard full weight wrought iron, steel or brass pipe with standard fittings or approved brass or copper tubing with approved fittings, except that approved flexible metal hose may be used for reducing the effects of jarring and vibration or where rigid connections are impracticable.

1415.1 Pipe used in the installation of domestic type burners shall not be smaller than ¼-inch iron pipe size; pipe used in the installation of industrial type burners shall not be smaller than ½-inch iron pipe size. Copper or brass tubing shall not be smaller in size than the equivalent of the iron pipe sizes mentioned above, with wall thickness not less than 0.049 inch. Flexible metal hose shall be installed strictly in accordance with the limitations of its approval.

1415.2 Piping shall be rigidly secured in place and protected from injury in a workmanlike manner, and where necessary, shall be protected against corrosion. Where practicable, oil piping shall be buried underground or in a concrete floor or placed in a metal-covered pipe trench.

1415.3 Pipe joints and connections shall be made tight in a workmanlike manner. Unions and tubing fittings shall be of approved type. Unions requiring gaskets or packing, and right and left couplings, shall not be used in oil lines.

1415.4 Proper allowance shall be made for expansion, contraction, jarring and vibration. Pipe lines, other than tubing, connected to underground tanks, except fill lines and test wells, shall be provided with double swing joints arranged to permit the tank to settle without impairing the efficiency of the pipe connections.

1415.5 Oil supply lines to burners shall be provided with approved strainers.

How This 7-in-1 Machine Does

Interchangeable steel rolls make this No. 172 Niagara Electric Combination Machine do seven different operations, and do them in a hurry. Send coupon for Bulletin.

Single Beading
O. G. Beading
Slitting
Wiring
Turning
Burring
Crimping
IN A HURRY
AT A PROFIT

COMPLETE EQUIPMENT FOR SHEET METAL SHOPS

Mail this Coupon for Bulletin Right Now

Niagara Machine & Tool Works
Buffalo, N. Y.

Please send data on:

☐ No. 172 Elec. Comb. Machine
☐ No. 164 Universal Combination
☐ Folders—Brakes
☐ Grooves—Seamers
☐ Slip Roll Formers
☐ Snips—Stakes—Hand Tools
☐ Shears; Squaring, Rotary
☐ Lever Shears and Punches

Name .....

Street .....City..... .....AA4

NIAGARA

Social Security

(*Continued from page* 17)

If State Has Approved Law

Contractor's payroll, for example is	$10,000
State tax, 1% (for 1936) will be	100
Federal tax, 1% (for 1936) before credit	100
Credit allowed against Federal tax for state tax paid (not to exceed 90%)	90
Net Federal tax	10
Total Federal and State taxes	110

Thus it will be seen that there are, in states that have approved laws, two separate 1% taxes (in 1936)—1% to the Federal government and 1% to the state. However, since the Federal law permits the 90% deduction, the total tax paid will amount to 1.1% on the payroll.

Contractors who are uncertain as to whether their states have unemployment insurance laws should get in touch immediately with their State Tax Commissions and get the latest information available.

What Records to Keep

It goes without saying that this Social Security legislation will require extra bookkeeping of some sort. The Federal Act does not specifically require any special accounting forms, nor will the Federal government furnish any forms except the blank on which the yearly return is to be entered and sent to the collector. The states may want copies of payrolls or other data.

The important point is, however, to begin now to keep "true and accurate records" of:

(a) the number of employes.

(b) wages, salaries, etc., paid these employes.

(c) hours (or days) worked by employes.

To gather and preserve this information it will be necessary to keep day-by-day or week-by-week records from January 1, 1936 forward.

Letters from Readers

(*Continued from page* 78)

will repair it with lead, while the roofer will substantially and permanently solder it.

The corrugated sheets are screwed to a lattice work of ⅞ in. x 10 in. boards spaced with 16 in. openings; and furring strips running the length of the corrugations are placed two and three strips to the sheet.

The majority of homes are small; approximately 10 feet by 20 feet, with frame sides, porch, board shutters and metal roof double pitched or hipped.

A few citizens realizing the decorative value of paint have used it lavishly even giving the outside rolled gutter bead an individual shade.

Rain is the main source of drinking water supply. As a result, gutters and spouts are kept in good repair to guide the liquid to barrels and cistern.

A common sight is the spouts high in the air running across the street along with telephone and power wires.

Although the Islands are 4½ days sailing from New York prices for material are comparable to our own. Theodore showed me a bill where for one bar of solder he paid 55c and a sheet of 36 in. x 96 in. 26 gauge Galvanized iron $1.10.

Lawrence E. Gichner,
Washington, D. C.

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Another of the many Peerless Furnaces that have been heartily endorsed by the trade. Peerless Model 48-A Steel Furnace not only answers the demand for a moderately priced furnace, but goes farther. It is constructed of materials that cost practically as much as genuine boiler plate, and incorporates the features of high priced furnaces . . . hot blast construction . . . riveted and caulked seams . . . draw-center rotating grate . . . double feed door . . . adaptable to oil or gas fire, and many others too numerous to mention. It will heat perfectly and easily stand the wear of many years of hard service. It can be furnished with or without casing. Peerless 48-A Steel Furnace is expensive in everything but price. It will appeal to your customers and when installed allow you a nice margin of profit and make another satisfied customer.

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PEERLESS HOME HEATING EQUIPMENT . . .

New York Program

The 13th annual convention of the New York State Sheet Metal, Roofing & Air Conditioning Contractors' Association, Inc., will be held in the Onondaga Hotel, Syracuse, N. Y., Monday, Tuesday and Wednesday, April 27, 28, 29, 1936. The program follows:

Monday, April 27th

"Constructive Ideas for the Sheet Metal Contractors," W. W. Graham—Tom Byrd, American Rolling Mill Company.

"Merchandising," Paul B. Andrews, Revere Copper & Brass, Inc.

"Relationship Between the Air Conditioning Contractor and the Oil Burner Dealer," H. F. Randolph, International Heater Company.

"Today's Competition in the Air Conditioning Field," H. T. Richardson, Richardson & Boynton Company.

"Social Security Act," E. A. Scott, Editor, Sheet Metal Worker; J. D. Wilder, Editor, American Artisan.

Tuesday, April 28th

"Merchandising," Frank Harmon, Lennox Furnace Company.

"Asbestos Roofing & Siding," A. O. Weller, Johns-Manville.

"Winter Air Conditioning," Eugene P. Ferris, Director, Central Bureau of Heating & Air Conditioning.

"Built Up Roofing," D. D. Hamilton, Koppers Products Company.

"What Price Prosperity," Dana W. Norris, Lennox Furnace Company.

"Corrosion of Air Conditioning Ducts," Moving Pictures, Republic Steel Corporation.

Wednesday, April 29th

"Merchandising Through the Federal Housing Act," Mr. Dorn, Director, F. H. A.

"Benefits of Cooperative Efforts," H. A. Daniel.

Reports of Officers and Committees.

Nomination and Election of Officers.

Installation of New Officers.

Banquet in evening.

◆

Milwaukee

The Master Sheet Metal, Heating, Ventilating and Air Conditioning Contractors Association of Milwaukee has approved its constitution and by-laws following consolidation of the two local associations. The air conditioning school is getting under way with about 150 members and contractors registered. Classes are held in the Builders Exchange. A membership drive is being organized for 1936. Officers for the coming year are—President, R. H. Fetting; V. P., E. F. Arndt; Secretary, H. H. Peters; Treasurer, A. C. Goethel; Executive Secretary, Paul L. Biersach; Directors—John Goodwin, Wm. Hanemann, A. Klubertanz, A. A. Walters, Walter Belau.

Paul L. Biersach,
Ex. Secretary.

◆

A. C. Mfrs. to Meet

The Air Conditioning Manufacturers' Association will hold its annual meeting at Hot Springs, Virginia, on May 16, President P. A. McKittrick has announced. Closing a year which has been marked by excellent progress in the interest of the air conditioning industry, the association is planning an even broader program of the constructive work called for by the industry's remarkable growth.

◆

Buffalo, N. Y.

The last regular meeting of the Buffalo Sheet Metal, Warm Air Heating, Air Conditioning Association was attended by over 50 members, of which this association is very proud. New member applications are coming in at every meeting. At one of our previous meetings it was decided to allow the wholesalers and jobbers to become members of this association.

To let the public know that there is a strong association in Buffalo it has been agreed that the association get signs and wire frames to fit on top of hood of all members' cars and trucks. These signs were placed on all members' trucks by April 15.

Officers of 1936 are—Leo J. Olear, President; William Gordon, Vice Pres.; Fred Frisch, Secretary; T. Cunningham, Fin. Secty.; Geo. Adema, Treasurer. Directors are—Nelson Irons, Frank Minet, John Zwelling, Max Reid, Herbert Ruff, Harry Yost, Geo. Adema.

Sick and Entertainment Committee—Max Reid, Mr. Smith, Mr. Hoesel, H. Ruff, F. Karnath, Charles Moore. Sergeants-at-Arms—Frank Heck, F. Karnath.

The last session of our air conditioning school was March 23. The school will reopen in the fall. President Leo J. Olear, has worked very hard to put this school in operation for the benefit of all warm air heating contractors. This school has been conducted by a well known heating engineer—Charles Lighthart, representative of the Furblo Co.

Fred Frisch, Secretary.

◆

Ohio Convention

(*Continued from page 77*)

per cent stronger than straight steel, shop operations must differ considerably from usual practice. In shearing, the shear blades should be set close together and should be sharp. In handling in the brake, precautions must be taken to prevent the material from bending in a long arc.

The principal speaker at the annual banquet was Bennet Chappel, known to millions of radio listeners as the "Ironmaster." Mr. Chappel gave some inside incidents connected with radio broadcasting, as for example the types of fan letters. Mr. Chappel said that he confidently anticipated increasing sheet metal business in the next few years. He declared that steel houses, now in their infancy, will be a future source of work for the sheet metal industry. Of all the opportunities offered the industry today, air conditioning, declared Mr. Chappel, looks most promising.

Thousands of products, declared the speaker, now made of other materials, will eventually be made of sheet metal.

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RYBOLT engineers have put all the knowledge and superior workmanship they have acquired in 26 years of quality furnace building into the making of this new type steel furnace. They have enabled us to put on the market the last word in steel furnace construction and performance—the new 14 point STEEL RYBOLT Furnace.

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Is Made Expressly For Heating Men. It Is Not Cobbled From A Unit Built For Some Other Purpose.

You can plunge the hose which has a 2" inside diameter to the bottom of a big can of ashes and it will empty it. It is sturdily built and so compact that it can be carried about the house or in any car with men and tools without special arrangements.

"A Plan to Increase Your Sales" goes with the machine which is not an arm chair theory but the outcome of successful experience.

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Wire clips. Positive, quick, economical.

DRESS up your product with handsome metal mouldings. Our engineers and stylists will help you.

Use Metal Mouldings for—

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—concealing joints
—simplified cabinet construction
—frames for registers and grills
—air dust joints
—inside and outside corners
—panel seaming
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We manufacture metal mouldings, of any material, in a wide variety of standard and special shapes and sizes. Our engineers are at your service.

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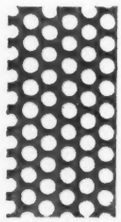

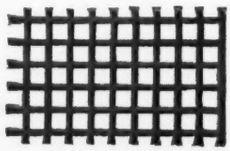

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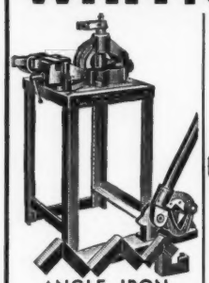

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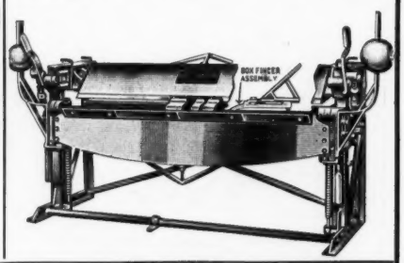
Combination Bending and Box Brake. Has 17 distinctive points of superiority. Send for descriptive literature.



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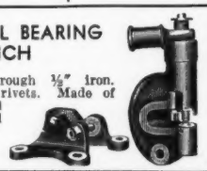
Capacity ½" through ⅛" iron. Will also drive rivets. Made of alloy steel and heat treated throughout.



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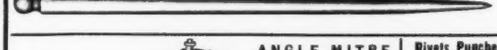

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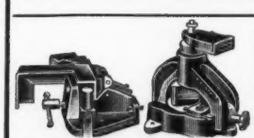

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Standard Code

American Artisan:

Will you please send us by return mail the proper way to figure gravity heating installation. Some say the Standard Code is not proper. What do you say?

H. C. W., Illinois.

Reply by the Editors

In reply to your query regarding the proper method of figuring gravity warm air heating installations, to our knowledge the Standard Code is the best method. Copy is enclosed for your convenience.

▲

Part Outside Air

American Artisan:

In the December, 1935, issue an article by William Scott, "Rules to Determine Register Temperature When C.F.M. Is Specified," raises some questions. There appears the formula—75.6 × C.F.M. (from outside) plus 5.4 C.F.M. (from inside), plus H equals Total B.t.u. required. I ask—1—How was 75.6 and 5.4 obtained? 2—For what conditions do these values apply?

Further I have a problem as follows: 1—Garage to be heated to 50 degrees. 2—Outside temperature 0 degrees. 3—Calculated heat loss 26,350 B.t.u. per hour. 4—No return air to be taken from garage. I would like to know: 1—The C.F.M. required if C.F.M. is figured at the register temperature of 150 degrees. 2—The additional amount of heat the furnace must supply because of amount of outside air taken in?

D. A. D., Ohio.

Reply by William Scott, Author

The formulas and rules given on page 32 of the American Artisan are based on the assumption of 70-degree room temperature and air measured at 70 degrees. However, by easy extension they may be made to cover all possible conditions.

The factor 75.6 is the B.t.u. per hour necessary to raise the temperature of one C.F.M. 70 degrees.

The factor 5.4 is the B.t.u. necessary to raise the temperature of one C.F.M. of return air from 65 to 70 degrees.

These factors are obtained in the following manner: .075 lb. equals the weight of one cubic foot of air at 70 degrees. .24 equals B.t.u. to raise one pound of air one degree of temperature. Then, .075 times .24, or .018, equals B.t.u. necessary to raise the temperature of one cubic foot of air one degree; and .018 times cubic feet per hour equals B.t.u. to raise the hourly air one degree.

But cubic feet per hour (C.F.H.) equals 60 times C.F.M. Hence, 60 times C.F.M. times .018, or 1.08 C.F.M., equals the B.t.u. needed to raise the hourly air one degree; and 70 times 1.08 C.F.M., or 75.6 C.F.M., equals B.t.u. to raise the temperature of the hourly air 70 degrees.

The factor 5.4, which provides for a five-degree temperature rise, is found by multiplying 1.08 C.F.M. by 5.

Now, as to your problem, for which you give the following data: Heat losses, 26,350 B.t.u.; outside air, zero; room temperature, 50°, register temperature, 150°.

Register temperature being fixed, the C.F.M. will be the same regardless of the source of the air. Then simply apply formula (3) in the article.

$$\frac{H}{1.08 \times (\text{reg. temp.} - \text{room temp.})} = \text{C.F.M.}$$

Substituting given data, we have:

$$\frac{26350}{1.08 \times (150 - 50)} = 244 \text{ C.F.M. measured at 70 degrees.}$$

But you ask for the cubic feet per minute at the register, where the temperature is 150 degrees.

This is seldom needed, but may be found by counting temperatures from absolute zero, thus:

$$\frac{150+460}{70+460} \times 244 = 280 \text{ C.F.M. at the register, at 150 deg.}$$

Since 5.4×C.F.M.=B.t.u. to raise the air temperature five degrees, it will take ten times as much for a temperature rise of 50 degrees, or in this case 54×244, which is 13,176 B.t.u. needed to raise the cold air to room temperature.

This may be proved as follows:

Let x=the number of B.t.u. required to raise the cold air to room temperature.

Then, TD : (reg. temp.—room temp.) : : × : 26,350.

In this case substituting,

50 : 100 : : × : 26,350.

Whence, x=13,175, which shows the answer to be substantially correct. Of course, this proof could be used as a method of geting the answer.

Finally, unless you desire to compare calculations with anemometer readings, it is seldom necessary to calculate the C.F.M. at the register.

◆

Cold Air Volume

American Artisan:

We have a gas furnace installation (gravity) installed several years ago that does not work properly because the installer failed to provide sufficient cold air return. There is about 1,000 square inches of warm air and only 515 square inches of return air. The owner wants to apply a blower, but does not want to increase the return air capacity. Will this make a satisfactory job? I claim that it will be necessary to provide more return air.

C. A. B., Kansas.

Reply by The Editors

Where the cold air supply is just a little short of the warm air supply we find that a revamped gravity system will usually operate satisfactorily on a blower, but for your particular needs, where the return is just about one-half of the warm air supply, we are a little hesitant in recommending such an installation due to the fact that 500 square inches of cold air return would be less than two 18-inch pipes or, possibly, one 26-inch pipe.

If the return consists of one 26-inch pipe we believe that drawing the amount of air required for the job through this one grille will result in objectionable floor drafts in the vicinity of the cold air grille, particularly if the grille is so located that it draws air from a group of rooms with doors opening to the room where the return register is located.

We believe you are quite correct in recommending at least two cold air returns having a capacity not less than 10 per cent below the capacity of warm air supply.

The Problem Corner . . . . . .

Ordinances

American Artisan:

After reading the articles appearing in American Artisan regarding air conditioning ordinances, we would like to ask if in any city the use of warm air conditioning units is permitted in the garage when it is attached to the house?

H. G. D., New York.

Reply by
The Editors

So far as we know, this location would have a number of objections—the garage would have to have a fire wall; would be objected to by the heating inspector and most city ordinances have specifications covering garages which are attached to the house. Such specifications are very specific with regard to what can be stored in the garage, what type of construction must be employed, etc.

We regret to say that we cannot cite any specific rulings on this question, but shall be glad to publish your inquiry in our 'Problem Corner" to see if any contractors have encountered a similar problem.

Can any readers supply rulings?

▲

Pipe Heat Loss

American Artisan:

Your articles, "Heat Loss From Basement Pipes" (November, 1934) and "Air Temperature Drop in Ducts" (October, 1935) have proved of interest to us. However, the two articles do not appear to be consistent in their results unless we have misapplied the information given. We would like to know how much testing work has been done on this subject and where.

H. W., Michigan.

Reply by
The Editors

We are pleased to know that the articles on heat loss from basement pipe have been of interest to you. We have not attempted to make the article by Kroeker coincide with the one by Ebaugh.

As a matter of fact, two or three engineers who checked the articles against test findings say that Ebaugh is a little high and Kroeker a little low and that somewhere in between the two theoretical calculations is the heat loss found by tests. We regret to say that we have not checked this against our test houses, but may do this some time during the winter.

So far as we know, very little actual testing work has been done on heat loss. We believe that considerable attention should be called to this problem as, in our estimation, it accounts for many of the troubles which can be traced to a too-low register temperature. The ordinary solution—namely, putting more air into the low temperature register—may be quite all right for the cold register, but has a tendency to upset the remainder of the system if the blower and furnace are sized closely to the heat loss.

Galvanized Smoke Pipe

American Artisan:

We have been having trouble with galvanized pipe peeling when used as smoke pipe. After short use the galvanizing starts to peel, leaving the bare, black pipe. We have used different brands, but usually have the same trouble. Sometimes it is with only a few sheets from a bundle. What is the reason and what is the remedy?

A. Z., Wisconsin.

Reply by
The Editors

We regret to say that we do not know any particular brand of galvanized sheet which can definitely be claimed as resistant to peeling when used as smoke-pipe.

We have heard a number of arguments at conventions on this subject and manufacturers generally state that it is a matter of a good tight galvanizing film.

However, we believe that peeling generally occurs when excessively high stack temperatures are used; you might check the particular jobs and see if this is the case. If it is, we suggest that either a limit control be used to keep the stack temperature down or, if this is not feasible, special metal resistant to heat and corrosion can be used for the pipe.

Have readers any suggestions?

December Problem

In the December, 1935, Problem Corner W. T., Ohio asked—"Will you please tell me if there is any short cut method for estimating the B.t.u. loss of a building?

Reply by
William Scott,
Bradfordwoods, Penna.

I would recommend to W. T. that he proceed as with a gravity job, by dividing cubics, walls, glass, etc., by their respective code factors. Then add results which gives the room basic factor. Then multiply by 1,000 and the result will be the B.t.u. loss per hour for zero weather. For weather below or above zero add or subtract 1½ per cent for each degree of variation from zero.

Humidity

American Artisan:

In your book "Practical Comfort Cooling" on page 13 it says—"If we wish to add enough moisture to bring 1,000 cubic feet of such air (70 degrees and 40 per cent R. H.) we must add 6 pints of water. The psychrometric chart shows 70°—40% is 45 grains per pound. 75 pounds for 1,000 cubic feet × 45 grains = 3,375 grains. 7,000 grains equals 1 pound. One pint equals 7,290 grains. Where the 6 pints?

Reply by
L. W. Millis,
Kansas City, Author.

You have called attention to Page 13 of "Practical Comfort Cooling" in which I said, in substance, that if one thousand cubic feet of air at zero, saturated with moisture, be heated to 70° we must add six pints of water to bring it up to 40% humidity. I thank you for calling attention to this error.

One cubic foot of air at zero can contain .54 grains of moisture and no more. Air at 70° can contain 7.99 grains. If we put only 40% of saturation into the 70° air it will then contain 3.20 grains. If it had .54 grains to start with, we must add the difference, which is 2.66 grains Then, of course, 1,000 cubic feet will require an addition of 2,660 grains.

One gallon of water is customarily rated as weighing 8.33 lbs. One pint would weigh 1.04 lbs. or 7,280 grains. 2,660 divided by 7,280 equals close to 36%, or a little over one-third of a pint instead of six pints. If close accuracy is desired it should be kept in mind that if the identical cubic foot at zero is warmed to 70° it will expand to more than the original volume.

▲

Insulation

American Artisan:

In removing a large hot water heating job from a building, we had a large amount of air cell four-ply pipe covering. Sizes ranged from 1½" to 5" diameters. Not having a place for same, I finally struck upon the idea of removing canvas and cheese cloth covering and by flattening same then placing same between joists in my attic as an insulator for heat and cold. Having a sufficient amount I was able to criss-cross and making from two to four layer thickness, laying on lath and plaster of ceiling.

I wish to know if there is any insulation value in re-using the asbestos covering in this manner.

Reply by
Professor J. D. Hoffman,
Purdue University

In reply to your question I am sorry to say that I would not be willing even to make a guess as to the insulating value of the material applied as suggested.

WHITNEY
LIFE TIME TINNER'S HAMMERS

Perfect Balance
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12 oz. Riveting Hammer

The head and handle are forged in one piece of high grade tool steel. The head cannot come off nor can handle splinter.

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Everyone wants FIRELINE that (1) makes cracked and broken firepots better than new, (2) protects new castings (they can't burn out), (3) increases heat producing capacity of any plant, (4) eliminates smoke, soot and furnace gas, and, (5) cuts fuel bills as much as 20%.
Quickly installed in any type furnace for a fraction of the cost of new castings, FIRELINE supports a labor profit of $10 per hour. It's so easy to sell that a couple of high school lads with our Free sales literature can keep you busy all summer selling door-to-door. Here is a real opportunity! Don't pass it up.

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Wissco Decorative Perforated Metals and Grilles in a wide variety of designs and combinations of designs meet today's exacting requirements of attractive appearance and practical utility.

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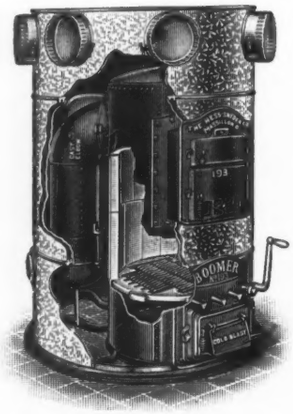

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Also made with duplex grates and upright shaker.

Have been successfully made for 23 years. Where introduced have given satisfactory service. The fire pot liners are the best we can buy and we know of several Boomers that still have the original liners in, which are 23 years old. We have been making cast iron Boomers for 50 years.

If you are interested in selling a strictly high grade furnace, ask for prices and agency.

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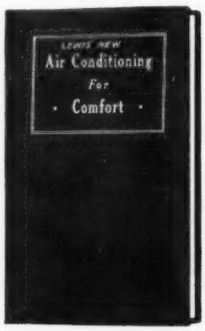

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"Air Conditioning for Comfort"
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277 Pages—$2.50
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So understandably does this new volume cover all angles of air conditioning that already dozens of schools teaching air conditioning have adopted it as a text. From it anyone may quickly acquire a thorough knowledge of equipment, psychrometry, refrigeration, humidification, dehumidification, heat transmission, heat absorption, air distribution, and water circulation. It also explains every step in the design of a complete heating and cooling system for a typical residence and a typical commercial building.

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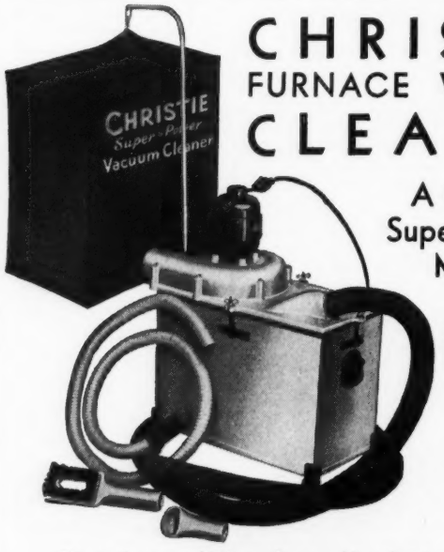

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We also manufacture the "Christie Giant" to operate from truck or yard.

Sold by Jobbers and Furnace Manufacturers.

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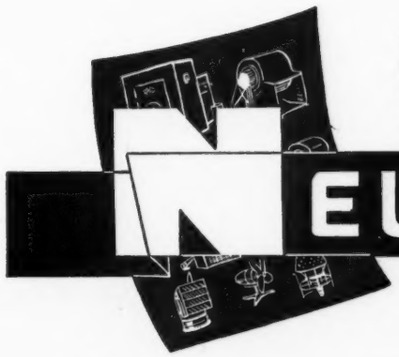


For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 74 and mail to us. Complete information will be forwarded.

● Indicates product not listed in 1936 Directory

△ Indicates product and manufacturer not listed in 1936 Directory

NEW PRODUCTS

20—Streamlined Blower

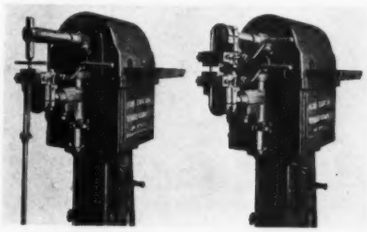
Lau Heating Service Inc., Dayton, Ohio, announces specifications for the new 600 Series Lau Furnace Blower, with the streamlined cabinet, finished in baked enamel and chromium trim. The unit is manufactured in six sizes,

rated 1,050 to 2,800 c.f.m. with two, three and four filters and motors from one-sixteenth to one-half h.p. A new type of wheel and scroll is utilized together with self-aligning, self-lubricating bearings and a three-point motor suspension.

◆

● 21—Welding Attachment

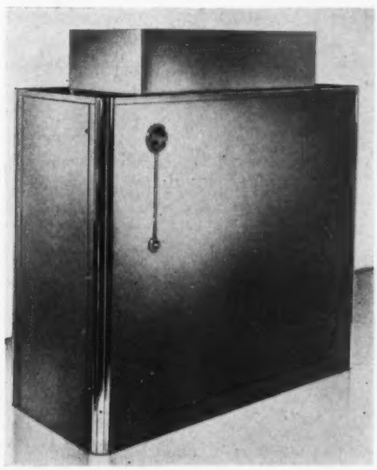
Acme Electric Welder Company, 5623 Pacific Boulevard, Huntington Park, California, announces the Acme Tee welding attachment which will fit practically every spot welder having 1¾-inch or 2-inch diameter horn. The attachment is designed to simplify and



facilitate the production of Tee welds or, by the application of a suitable attachment, a Butt welding operation. The jaws will accommodate any size wire from No. 16 gage up to ½-inch round diameter. All moving parts are reversible so the unit can be operated either right or left handed or upside down.

22—Oil Burning Furnace

The Herman Nelson Corporation, Moline, Illinois, announce several new products, among which is an oil burning-air conditioning furnace unit, styled and finished in the modern mode and designed to provide all the proper air conditioning for comfort including heating, air motion, humidification and

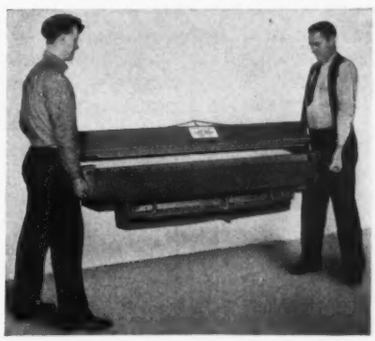


air cleaning with optional cooling and dehumidification. B.t.u. capacity is 150,000; the burner uses No. 3 oil, 1.35 gallons per hour and has an air capacity of 1500 to 2000 c.f.m. The furnace uses the Herman Nelson conversion oil burner of the gun type of a capacity listed above.

◆

23—Portable Brake

A new portable brake built in 4 and 5-foot widths and light enough to be



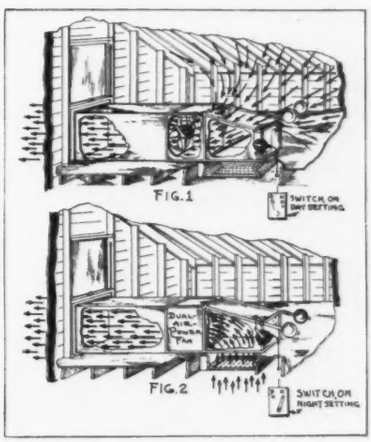
carried and set up by two men, is announced by Dreis & Krump Mfg. Co., Chicago. The brake is especially suited for work where a field machine is required. The machine will handle any sheet lighter than 20 gauge. For carrying the legs swing up under the machine. Top and bottom sections are made of embossed steel plates while the bending leaf consists of a solid plate reinforced with a specially formed plate. Top section and bending plate can be detached without changing any setting.

Clamping handles operate independently and move downward as a result of which the brake always remains in place and extra power is gained. The brake has a detachable handle (either right or left) fastened onto the leaf hinge to operate the leaf when long sheets are in the machine.

◆

24—Attic Fan

General Regulator Corporation, 2606 W. Arthington Street, Chicago, announces the Auto-Attic system of cooling, consisting of a propeller-type fan mounted in a housing which also contains a balanced damper to admit air to the fan either from the attic direct or from ducts or registers connected to rooms below. The damper is electric-



ally controlled from a switch. The fan used has a blade divided into two elements with a slot between the two sections. The two blade sections (called an entering blade section and trailing blade section) operate on what is known as the Duo-Gyrovane principle. In operation the two blade sections cooperating set up a vacuum in the slot; a pull-push effect. Velocity pressure in front of the blade takes advantage of atmospheric pressure existing in back of the blade.

New Products . . . . . .

25—Tinner's Hammer

The W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill., announce their new Lifetime Tinner's Hammers, manufactured under the Estwing Patent No. Re 16820. These hammers are made in two sizes, the 12-ounce riveting hammer and the 18-ounce seting hammer.

Head and handle are forged in one piece from high grade tool steel which gives perfect balance, and eliminates

all possibility of the heads coming off, or of the handle neck splintering or being chewed by sharp metal edges.

The handle is forged in an I-beam shape, giving a maximum in strength with a minimum in weight. The grip is fashioned from laminations of sole leather pressed over the I-beam and securely riveted, then polished and double lacquered.

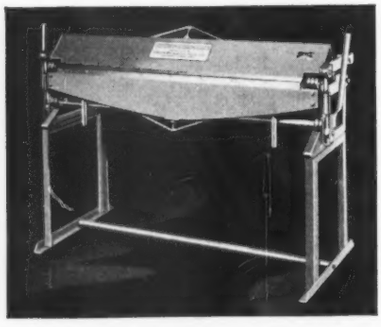
◆

26—Bending Brake

Whitney Metal Tool Company, 110 Forbes Street, Rockford, Illinois, announces an "Air Condition Special" bending brake.

This brake weighing only 265 pounds, permits two men to carry this brake from job to job. The size of this brake is 4 feet 1 inch in length; capacity, 20 gauge commercial iron.

Turn buckle adjustments are used for rapid adjusting for various thick-



ness of material, with a graduated scale at the hinge lugs for duplicating work. The upper jaw is box type welded construction. The lower jaw has welded reinforcements with a one inch projection for offset work. The bending leaf has angle iron welded underneath. The three members are provided with truss rods for further adjustments. The brake can be had in either floor or bench type.

● △ 27—Damp Proofer

Gerard Chemical Co., 87 Front St., Elizabeth, New Jersey, announces investigations which indicate that the company's product El Glykol can be used as a coating for such polished metals as brass, bronze, nickel, chromium and stainless steel. The material provides an anti-rust coating which prevents rust and maintains the original surface appearance. El Glykol is a colorless damp proof liquid, consisting of a pre-oxidized chemical product dissolved in a light petroleum oil. Upon application, the material dries by evaporation and in use does not oxidize or crumble. Neither does it become hard or brittle, but remains flexible and elastic. It can be applied at any temperature, either by spray or brush.

In addition to uses on metal, the material can be used as a waterproofing compound on masonry, wood, canvas and many other materials. It may also be used as a paint thinner, or can be used as a vehicle for aluminum and bronze paint. It may be used to protect and maintain the copper patina, or to preserve the appearance of painted metal surfaces.

◆

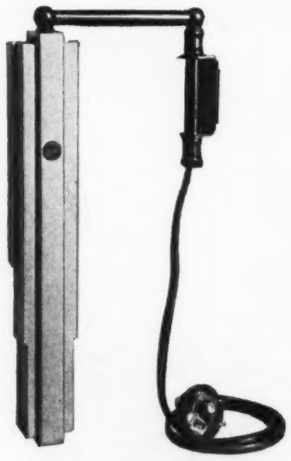
28—Air Conditioning Furnace

A new oil-burning furnace with matched blower-filter unit to be known as the Comfortol, is announced by The Waterman-Waterbury Company, Minneapolis, Minn. The furnace will be made in seven sizes, ranging from 1½ to 3 gallons per hour oil consumption and rated from 142,763 to 285,525 Btu. output per hour at the register. Matched fans are furnished in four sizes, ranging from 1,250 to 6,800 c.f.m. against .0625 static pressure to 550 to 6,100 c.f.m. against .25 static pressure. The largest sized fan will deliver 3,500 c.f.m. against .375 static pressure.

The whole unit is furnished in baked enamel, green finish with chrome trim. The furnace consists of a steel drum with special three-sided, rectangular radiator of welded copper steel, properly baffled to insure long, counter flow, flue travel and extensive heating surface. The matched fan is designed to provide five to six air changes per hour. Full automatic control for the burners, fan and furnace are provided. A special mixing orifice insures equal air temperatures and pressures in the bonnet. The burner is concealed inside the housing. A special type humidifier, consisting of a capillary drum, is mounted just below the duct take-off. Provision is also made for a cooling coil for cold water, ice or mechanical refrigeration.

29—Windowstat

Julien P. Friez & Sons, Inc., Baltimore, Maryland, announce the Friez windowstat. An instrument which is fastened to the frame of a window and pressed against the glass where its sensitive humidity element registers the humidity condition at the glass surface, and through electrical contact



over-rules the ordinary wall humidistat and shuts down the humidifier before a humidity percentage is reached which will result in condensation on the windows. By use of this instrument, humidity indoors is maintained at a point above the dewpoint of the humidified air on the glass. The company has prepared a catalog which shows the construction and proper application of the instrument, contains a complete description of the design and construction of the unit with full explanation of its operating characteristics, how the instrument should be wired into the humidity-solenoid valve circuit and how various percentages of humidity can be established by setting the instrument. The company has also prepared a condensation on single glass chart showing highest permissible inside relative humidity with various outside temperatures.

◆

● △ 30—Vibration Deadener

Two types of vibration eliminators and a new development in cork pads are announced by the Vibration Eliminator Co., 41 37th St., Long Island City, N. Y. The small sized unit consists of a metal cap to which the machine is bolted, a lower metal base which is lagged to the floor with a special cork pad in between. The medium sized unit has the same construction, but is rectangular rather than round and is for larger machines. The largest unit consists of a pattern of strips of cork confined by a metal frame.

The small unit is for loads from 50 to 400 pounds each, the medium size 500 to 2,000 pounds each and the large size for heavier weights. The large size is furnished in 1, 1½, 2, 3, 4 inch up to 24 inch thickness. By means of a special bracket the small unit can be reversed for suspended machines.

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Rubyfluid

Skylights

(*Continued from page* 18)

bar, obtain its girth 1 to 8 shown in the side section and place it on the vertical line drawn above the front section as shown by similar numbers. Through these points draw the usual measuring lines and intersect them by vertical lines drawn from intersecting points on the common bar, which will give the desired miter cut. When laying out the full length pattern for the cross bar measure from the arrow point and reverse miter cut for opposite side. This completes all the necessary patterns for constructing flat skylights on pitched roofs.

Estimating Materials

As an example in estimating the quantities, assume a flat skylight 4 ft. 4 in. x 8 ft. 4 in. with a 2-inch shoulder all around as shown in Fig. 5. Referring to the curb section at the right in Fig. 4, front section, note that the bottom at the bar is flush with the shoulder. This makes a rigid construction and places the entire weight of the skylight on the wood or angle iron curb frame in the roof.

To avoid waste of material, the girth of the common bars, cross bars and curbs, should be of such widths that they can be cut from stock sizes of sheets either copper or galvanized copper steel without waste. Assume that the girth of the common bar "C" in Fig. 3 is 6 in., its cap 2 in., and the lower wall "D," 2 in., making a total of 10 in. The width of the skylight in Fig. 5 is 4 ft. 4 in. minus 4 in. off for shoulders leaves 48 in. plus top and bottom flanges of 2 in. or 50 inches: $50 \times 10 \times 7$ bars $= 3{,}500$ square inches.

The girth of the side curbs in Fig. 4 (front section) equal 8 in. The length of the side curbs in Fig. 5 is 52 in. plus 2 in. for flanges or 54 in.: $54 \times 8 = 432 \times 2$ sides equal 864 square inches.

We assume the girth of the rear curb to be the same as the side curb, or 8 in. The length of the rear curb is 100 in. plus 2 in. for laps or 102 in.: $102 \times 8 = 816$ square inches. The girth of the front curb is 5 in. $\times$ 102 $=$ 510 square inches.

We then have

3,500 sq. in. for seven bars.
864 sq. in. for two side curbs.
816 sq. in. for rear curb.
510 sq. in. for front curb.

5,690 total sq. in. of metal.
$5{,}690 \div 144 = 40$ sq. ft.

Assuming 16 oz. cold rolled copper will be used for the construction then 40 lbs. of copper would be required. If number 22 gauge galvanized iron is used, which weighs 1.25 oz. to the sq. ft. then $40 \times 1.25 = 50$ lbs., the amount required.

In addition to this, 32 brass bolts and nuts $\frac{1}{8}$ in. $\times$ $\frac{3}{8}$ in. will be required for securing the capping over the bars and side curbs, also 14 round head brass wood screws and 14 lead washers to secure the skylight to the wooden curb on roof.

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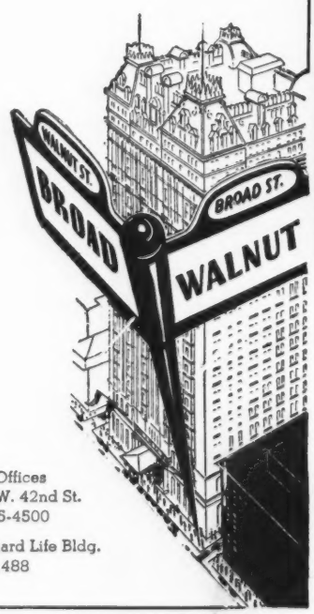

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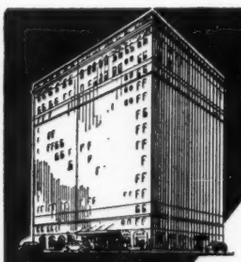

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WANTED: Experienced furnace and air conditioning salesman for midwest territory. Give references and past record. Address Key 357, "American Artisan," 6 North Michigan Ave., Chicago.

WANTED FOR INDIANA territory Department Manager thoroughly experienced in the estimating and selling of sheet metal, and roofing work. Give references, experience and age. Compensation will be based on drawing account and percentage of profits. Write "American Artisan," Key 364, 6 N. Michigan Ave., Chicago.

SALESMAN WANTED: We are desirous of obtaining experienced salesmen for Iowa, Minnesota, Kansas and Missouri. Our dealer plan allows Air Conditioners on Consignment, Freight allowance, Quantity Discounts and Finance Arrangement similar to F. H. A. Every co-operative plan to get dealers including low price which is made possible by the elimination of distributors. See our advertisement on pages 46 and 47. Drawing account to man of proven ability. Give details in first letter. Do not answer this advertisement unless you can prove past results. Joliet Heating Corporation, Joliet, Ill.

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WANT TO HEAR from someone who has 8 ft. cornice brake, stove pipe crimper and beading machine for sale. Must be in good condition. Address J. D. Jacimore, Russellville, Ark.

FOR SALE

OWING TO DEATH of owner, must dispose of old established sheet metal business in thriving town of 16,000 population in northwestern Ohio. Practically complete set of tools—fair stock. No reasonable offer refused. Address Key 363, "American Artisan," 6 N. Michigan Ave., Chicago.

FOR SALE: Cheap. Rightway Oil Burner complete, in perfect condition. Also Cook Electric Oil Pump. Address: E. Moyemont, Odell, Ill.

FOR SALE: Old established sheet metal and roofing business, centrally located in San Antonio, Texas. Write "American Artisan," Key 365, 6 N. Michigan Ave., Chicago.

If you have anything to sell, if you are looking for a "good buy," if you are seeking a connection or if you are looking for a salesman—use the Classified Page of "American Artisan."

MISCELLANEOUS

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8 Ft. Pexto 20 ga. Shear compl., $225.00
10' 14 ga. Ohl Power Shear, $600.00
8' 16 ga. Chgo. Steel Brake, $145.00
ROLL, 60" 14 ga. Beloit Power Slip, $250.00
PUNCHES, HAND, No. 58 Nia. 36" throat, $85.00
Clough—18" throat, $45.00
STAKES—Over 50 in stock; SQ. Head, $3.00; Hatchet, $3.50
GROOVERS, 95% New No. 520 Pexto 20 ga., $85.00
PUNCH PRESS No. 15 Toledo, 18" throat
KICK PRESSES No. 2 Nia.; No. 2 Walsh
BEADING MACHINE 12" thr. 20 ga., $27.50
NIBBLERS No. 1-A Campbell; No. 1 Gray
GANG SLITTERS 30" Cameron—8 sets cutters
POWER APRON BRAKES 10' 10 ga.; 6' 3/16" Chgo. Steel 16 ga. Ryerson Throatless Shear, $22.50.
POWER SHEARS, 5/16" x 156" & 10 Ft. 3/16".

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SHEET METAL MACHINERY
We Can Save You Time and Money
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NEW & USED

"Draw on the MOST COMPLETE STOCK IN AMERICA"
ROLLS—SHEARS—BRAKES—SPOT WELDERS—PUNCH PRESSES—PRESS BRAKES—FOLDERS—DRILLS—HAND MACHINES—STAKES.

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INTERSTATE MACHINERY COMPANY, INC.
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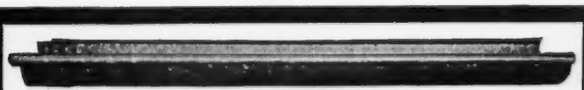

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Bead is cut back, making it easy to put gutter together. Requires no soldering—not affected by expansion or contraction.

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229-237 Arch Street, Philadelphia, Pa.

Index to Advertisers

Firms represented in this issue are identified by the folio of the page on which their advertising appears. Advertising which appears in alternate issues is marked with an asterisk.

April, 1936

Aeolus Dickinson 91
Aerofin Corp. 59
Air Controls, Inc., Division of The Cleveland Heater Co. .. 61
Allegheny Steel Co. ..... *
American Air Filter Co., Inc... *
American Brass Co..... 5
American Radiator Co..... *
American Rolling Mill Co., The 53
American Sheet and Tin Plate Co. ..... *
Auer Register Co. ..... *
Automatic Humidifier Co..... 60
Autovent Fan & Blower Co.... *

Baldor Electric Co. 44
Barber Gas Burner Co., The... 59
Bead Chain Mfg. Co. ..... *
Bellevue Stratford Hotel..... 92
Benson Co., Inc., Alex R. .... *
Berger Bros. Co. 93
Berger Mfg. Co., Div. of Republic Steel Corp. 96
Bishop & Babcock Sales Co. ... *
Brauer Supply Co., A. G. 91
Breuer Electric Mfg. Co. 84
Brillion Furnace Co. ..... *
Buffalo Forge Co. 28

Canton Steel Ceiling Co. ..... *
Capitol Furnace & Stove Repair Co. ..... *
Central Furnace & Stove Repair Co. ..... *
Century Engineering Corp. .. *
Chandler Co. ..... *
Christie Cleaner Co. 88
Clarage Fan Co. 61
Columbus Humidifier Co., The *
Cook Electric Co. 56

Dail Steel Products Co. 52
Detroit Lubricator Co. 25
Dreis & Krump Mfg. Co. 77

Electric Vacuum Cleaner Co., Inc. ..... *
Elgo Shutter and Mfg. Co. .... *
Excelsior Steel Furnace Co., The 57

Faultless Heater Corp. ..... *
Fireline Stove & Furnace Lining Co. 87
Fox Furnace Co., The 27
Friez & Sons, Inc., Julien P. .. 54
Furblo Co. 64

General Electric Co. ..... *
Grand Rapids Furnace Cleaner Co. 83

Harrington & King Perf. Co. .. 84
Hart & Cooley Mfg. Co. 57
Hart Mfg. Co., The ..... *
Henry Furnace & Foundry Co., The 76
Herron-Zimmers Moulding Co. 83
Hess-Snyder Co. 88
Hess Warming & Ventilating Co. 63
"Home Comfort" Furnace & Mfg. Co. ..... *
Hotel Lenox 91
Hotel Melbourne 92
Hussey & Co., C. G. ..... *

Illinois Testing Laboratories, Inc. 64
Independent Register & Mfg. Co. 71
International Engineering, Inc. 64
International Nickel Co., Inc. . 7
Interstate Machinery Co. 93

Joliet Heating Corp. ....46 and 47

Laclede-Christy Clay Products Co. 88
Lamneck Products, Inc. 66
Lau Heating Service, Inc. .... *
Liberty Foundry Co. 84
Lincoln Electric Co., The 75

Maid-O'-Mist, Inc. ..... *
Marshalltown Mfg. Co. 79
Maurey Mfg. Corp. 62
Mercoid Corp., The 61
Meyer & Bro. Co., F. 8
Meyer Furnace Co. ..... *
Minneapolis-Honeywell Regulator Co. 51
Monmouth Products Co. 26
Morency-Van Buren Division Scovill Mfg. Co. ..... *
Mt. Vernon Furnace & Mfg. Co. *
Mueller Furnace Co., L. J. 45

National Foundry & Furnace Co. ..... *
National Super Service Co. ... 87
Nelson Corp., Herman ..42 and 43
New Haven Copper Co. 74
Newport Rolling Mill Co. 91
Niagara Machine & Tool Works 80
Northwestern Stove Repair Co. *
Nu-Way Corp., The 49

Ohio Electric Mfg. Co. 61
Osborn Co., J. M. & L. A. 6
Owens-Illinois Glass Co. 55

Pacific Gas Radiator Co. 62
Parker-Kalon Corp. ....72 and 73
Payne Furnace & Supply Co. .. 64
Peerless Electric Co. 63
Peerless Foundry Co. 81
Peoples Oil Burner Co. 58
Perfection Stove Co. 65
Premier Division, Electric Vacuum Cleaner Co., Inc. ..... *
Pyrolite Products Co. 91

Randall Graphite Products Corp. 60
Republic Steel Corp. .....
.....Inside Front Cover
Revere Copper & Brass, Inc.... 9
Richardson and Boynton Co. .. 95
Round Oak Co. ..... *
Ruby Chemical Co. 91
Rudy Furnace Co. ..... *
Russell Electric Co. 3
Rybolt Heater Co., The 83
Ryerson & Son, Inc., Joseph T. 10

Schwitzer-Cummins Co. 48
Scovill Mfg. Co..... *
Stanley Works, Inc. ..... *

Swartwout Co., The..... *
Thompson & Co. 83
Thompson Mfg. Co..... *
Tork Clock Co. 60
Torrington Mfg. Co. 62
Trane Co., The 46
Twentieth Century Heating & Ventilating Co. 91

Victor Electric Products, Inc... *
Viking Shear Co. 91

Walsh Refractories Corp. .... *
Ward Machinery Co..... 93
Waterloo Register Co., The 24
White Mfg. Co. 63
Whitney Mfg. Co., W. A. 87
Whitney Metal Tool Co. 84
Wickwire Spencer Steel Co. ... 87
Will-Burt Co., The 63
Wilson & Co., Inc. ..... *
Wisconsin Humidifier Co. 62
Wise Furnace Co., The 79
Wood Industries, Inc., Gar 46

XXth Century Heating & Ventilating Co. 91

Show them!

Maybe they're from Missouri. All right . . . take your prospects to an actual R & B installation job—and *show* them! That's the way to clinch the the sale of R & B heating equipment.

Demonstrate how the attractively lacquered case is more than just a basement ornament. Show them how it provides space for either automatic-stoking or oil-burning equipment. And don't forget that folks are air-minded these days, so stress the modern application of warm air heating to air-conditioning. Show them how the humidifier gives just the right degree of moisture to heated air and how warm air heating provides, throughout the house, a continuous supply of clean air at an even temperature . . . and then point out the space for the blower unit and the advantages of this method of circulating fresh, cool air in summer.

If your prospects are from Missouri, they'll also want to know about the firm behind their heating equipment. Show them how the R & B laboratory tests every product before it's placed on the market . . . stands back of its equipment. Then let your prospects talk to an R & B owner, learn first-hand how R & B heating equipment is the best money can buy . . . and the cheapest in the long run! And then watch your prospect from Missouri turn into another satisfied R & B client.

RICHARDSON and BOYNTON Co.

244 MADISON AVENUE NEW YORK CITY

Branch Offices in Principal Cities

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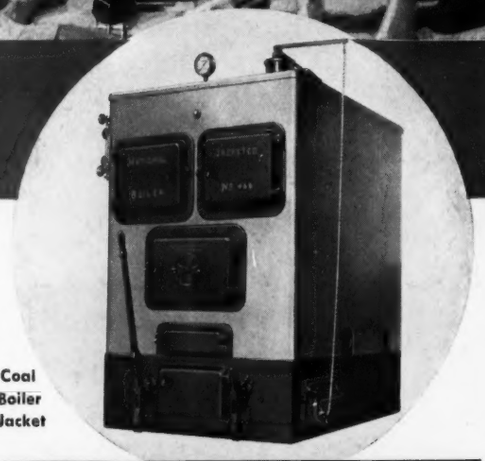
Increased utility and arresting beauty can be built into jackets for boilers, oil burners, stokers, air-conditioning units, etc., through the capabilities of Berloy engineering service. Berger offers in one organization a group of expert designers and metal-working specialists, supported by outstanding facilities for the manufacture of sheet products of every description.



Coal Boiler Jacket

Air-Conditioning Cabinet

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Consult Berger now, we will immediately place a Berloy engineer at your service.

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